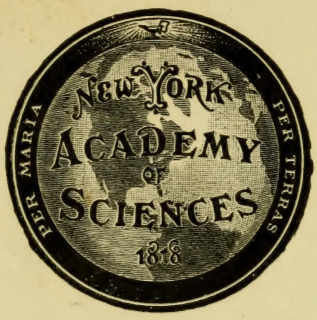

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PROCEEDINGS

AND

TRANSACTIONS

OF THE

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ADDITIONS AND CORRECTIONS.

PAGE	LINE				
32	3	For	*Rhodite*	read	*Rhodites.*
82	15	,,	sanguinea	,,	sanguineum.
85	6	,,	nudiflora	,,	nudiflorum.
165	25	,,	MACROMUS	,,	MICROMUS.
168	33	,,	Sron-mhail	,,	Sron-mhail-choin.
385	18	,,	RUSSULUM	,,	RUFULUM.
	24	,,	SIPHLONURUS	,,	SIPHLURUS.
iv	30	,,	*Eupatoria*	,,	*Eupatorium.*
xxxiii	3	,,	*alpinum*	,,	*alpinus.*
xxxiv	4	,,	*alpinum*	,,	*alpinus.*
	20	,,	*lacrimans*	,,	*lacrymans.*
xxxv	35	*After*	Hedw.,	*insert*	var. *arenicola*, Braithwaite.
xliii	3	For	*alpinum*	read	*alpinus.*
lxxvi	25	,,	*Jacobeæ*	,,	*Jacobææ.*
lxxvii	26	,,	*Jacobeæ*	,,	*Jacobææ.*
xci	4	,,	Devonport	,,	Davenport.
	last	,,	Zagrab	,,	Zagreb.

TRANSACTIONS

OF THE

NATURAL HISTORY SOCIETY OF GLASGOW.

I.

NOTES ON THE COMMON LIMPET.

BY DAVID ROBERTSON, F.L.S., F.G.S.

[Read 23rd March, 1884.]

THIS last summer, while at the coast, I took the opportunity of making a few notes on the habits of the Limpet, *Patella vulgata*, Linn., with the view of verifying a few points regarding the periodic movements of the animal in its natural haunts, its mode of cropping the filamentous algæ, and the power it is said to possess of scooping out cavities in the sandstone rocks.

Aristotle described the habits of the limpet, and showed that it leaves its place on the rocks and goes out to feed. This was confirmed by Reaumur, although Borelli and others asserted that the limpet remained all its life fixed to the same spot. Bouchard-Chantereaux stated that he had often seen the limpet crawling, especially just after the tide had gone out. The young limpet moves freely about, and shifts its quarters; but after attaining a growth of probably a few days, it affixes itself to a particular spot, which it only quits, when covered by the sea, on the return of each tide.*

Seeing that these statements do not altogether agree, I shall endeavour to supplement them with a few facts which came under my own observation. To ascertain the movements of the animal in its

* Jeffreys, *British Conchology*, iii. 231.

natural haunts, I placed over it an arch made from a piece of iron hoop with a wire let down through the arch resting on the crown of the shell, so that when the animal left its place the wire dropped on the rock. By this means, on visiting the place at each tide when the shell was uncovered, I could see whether it had shifted or not. To prevent as far as possible the indicating wire being acted on by the pressure of the waves when the sea was in any degree rough, a thin brass tube five inches long was fixed in the arch and the wire let down through it, by which means the lateral motion of the wire was reduced to a minimum. The observations were regularly carried on from the 21st June till the 20th August, 1883, and were made on different limpets and on different zones of the tidal belt. It was found that no one of the different limpets was regular as to the period when it went out to feed. The same animal sometimes went out for one or two tides consecutively, and at other times alternately, and occasionally not till the third or fourth flow of the tide. Those near high water were less regular than those lower down. This may be explained by those higher up on the tidal belt being for a shorter time and less regularly covered by the tide. The rocks near high water are often thickly covered with young balani which surround the limpets very closely. It was noticed that there was always a little bare space on one or other side of the shell. In these cases the animal, after being out to feed, was always found back close to the drop wire, as if endeavouring to get back to the exact spot it had left.

Mr. George Roberts, in the *Ann. Mag. Nat. Hist.*, gives a case illustrative of the precision of the limpet in adjusting itself to the exact spot which it had left, and in this case apparently with a purpose. He says: "Above the level of the water was a smooth place from which a limpet had not long before moved. As the spot was different in colour

to the rock around, the shape of the impression was singular. Looking into the water I saw several limpets there. I was not long in spying my friend who was from home, and found him leaving the others and making his way steadily back to his habitat. I watched his course: he arrived, and I at once perceived a difficulty which he made nothing of, viz., the getting adjusted; he slewed himself round and fitted a little notch that was in the edge of his shell to a small piece of projecting quartz with wonderful readiness. He was tight in a moment ready to resist the heaviest breakers or any enemy."

It would have been interesting to know if the limpet continued to take advantage of this lockfast, and whether the notch in the shell was not caused by his studiously propping himself up against the projection. The shell as represented is of rather a singular shape, and suggests the probability that its natural expansion had been interfered with, either by the choice of the occupant or by force of circumstances.

In situations where balani abound I have never found the limpet beyond the bare space surrounding its site, probably because it could not or was not inclined to walk over the sharp points of the balani.

Occasionally those near high water have a tuft of *Fucus vesiculosus* growing on the shell, and in some cases bushes seven or eight inches long, which would be dangerous appendages for a limpet to be encumbered with under a rolling sea. Further down on the tidal belt, where the rocks were clean and smooth, the limpets were occasionally found to have settled down a few inches from the spot which they had left, and again by another tide or two were back on their old site.

The following experiments, made with a limpet in confinement, confirm the above statements; although we cannot expect that the natural habits of the animal will be shown so well in confinement as in

its native haunts, yet some facts can be ascertained in this way that could not otherwise be determined. In a glass vessel the action of the mouth can be distinctly seen, and even heard, which it could not be on its native rock, nor could the marking of the teeth of the tongue on the fine filamentous algæ be so well observed on the rough rock as on the clear glass jar. The glass jar used was six inches deep and nine inches in diameter. A limpet one-and-a-half inches long was placed on the bottom and covered with two inches of sea-water.

Other limpets were put into different vessels, some beginning to move soon after being put in, and others at intervals of longer or shorter duration; but on the whole they were found to be so similar in their general movements that I have confined my remarks to the behaviour of the one referred to.

During the first two days it was not seen to move from the spot on which it was first placed. On the third day it moved about two inches along the bottom, where it remained till the afternoon, when it moved from the bottom up the side of the jar to the edge of the water with about one-third of the shell above the surface, and there settled with its head downwards, as it always does when it goes to rest. The edge of the water is a common situation to rest on, sometimes more and sometimes less of the shell being under water and occasionally the whole of it. I only once saw it leave the water for two or three minutes. When the animal is at rest the body is a little contracted, leaving a small space occupied by water between it and the shell. When the animal moves to one side the water space is increased on the other; and during these movements the neck is much elongated, and the head can be turned so far round as to reach nearly half-way down the side of the body.

From the margin of the mantle light-coloured retractile filaments or cirrhi of various sizes pro-

trude beyond the shell, the longest and strongest corresponding well with projecting ribs of the shell.

The speed that I have seen the limpet attain on the side of the glass was one inch in the minute, and probably it can do much more. The greatest distance I have seen it travel was thirty inches. I never saw it out browsing longer than two hours at a time, frequently much less; and it never seemed to be much on the move except when browsing. The chief food of the limpet appears to be algæ. I have only had an opportunity of seeing it feeding on the fine filamentous kind grown from the spores on the wall of the glass jar. I have noticed with regard to those in tide pools, where the bottom was covered with *Melobesia*, that their shells were more opaline than any I had seen elsewhere. Whether that circumstance arose from their feeding on the *Melobesia* I am not prepared to say. I have often noticed in tide pools that the bottom was thickly covered with *Melobesia*, except the exact spot a limpet was on, which was always quite bare; and the *Melobesia* may have been prevented from growing by the presence of the limpet, or have been used by the limpet for food; but the latter supposition is not so probable, as the alga surrounds the shell closely and is absent only under the shell. Whether the limpet can subsist on other than vegetable food seems yet an open question.

The limpet I had in confinement was at first put into a clean glass jar, and to all appearance with pure sea-water. It was twelve days afterwards before a vestige of sea-weed was noticed on the side of the jar; yet, as the animal was regularly passing fæcal matter, we may presume that it must have been getting food of some kind, possibly plant spores. Forbes and Hanley state that "although capable of moving about with facility when well-grown, it appears to become lazy and sedentary, often living in crevices, where having once lodged it remains till it becomes too large to come out. In such cases it

certainly cannot subsist on fuci, as generally supposed, but must depend on the waves for a supply of some other kind of food, possibly infusorial."* A similar case once came under my notice, of a half-grown limpet that had got jammed between the inequalities of two large stones. It obviously had been there for a considerable time, as the shell had grown into a triangular shape to conform to the walls of its prison. This creature also must have depended for support on what the waves carried in to it.

To test whether an adult limpet subjected to confinement could live for any length of time, on the 20th August I drilled a circle of holes in the rock round two well-grown limpets that were close together, and inserted wooden pegs so near each other that the animals could not get out. As I had to leave, my friend, Mr. Cook, Millport, visited them occasionally and found them all right till 20th December, when it was found that one of the pegs had given way and one of the limpets had made its escape to a little distance; but the other was all right within its enclosure, having subsisted within a space of not more than a quarter of an inch beyond its shell for 124 days, and how much longer it may be able to endure prison life I may at another time be able to record.

To find how often in confinement the limpet shifted its site, I placed a piece of perforated zinc over the jar, letting down through the perforations a thin wire on each side of the limpet, so that if the wires were disturbed, although the animal was on the same spot as when last seen, this showed that it had been moving. A small gummed ticket was placed on the outside of the glass opposite the animal, which indicated whether it had returned to the same spot which it had left. Sometimes it went to the right side, and sometimes to the left; and when it settled down on the bottom of the jar,

* *Brit. Mollusca*, ii. 424.

which it did but seldom, the wire was let down on the top of the shell.

Although, as stated, more of the movements of the animal could be seen in confinement than when at liberty, yet it was found during observations made every morning and evening, and frequently at other times of the day and night, over 61 days, that there was not much difference between the habits of the limpet in the one case and the other. In confinement as well as at liberty it generally went out to browse about once in every twelve hours, occasionally in about twenty-four hours, and a few times only once in from thirty-five to forty-eight hours. As the exact time when it commenced to move was not always seen, in such cases the time was taken from the last observation, which did not give the exact time or interval between the one move and the other; but it was found that it always corresponded closely with the duration of one or more tides. Sometimes it went out to feed at intervals of three or four hours, but such irregularities were quite exceptional. With the help of the small gummed tickets I was able to mark every change of position that the animal made, which amounted to nine in number during the 61 days. These changes were numbered on the tickets as they occurred, leaving them all before my eye on the glass. From these marks I found that it would return once or twice to the same spot, then change to another, then return back again to where it had been at first. Sometimes it would settle on the exact spot it had left five or six days before, and once as far back as thirteen days. Generally it settled on the exact spot it had formerly occupied, yet occasionally it would be a little to the one side or the other. In most cases it came down on the site from above, and occasionally rested a little before it finally reached it.

Regarding the functions of the tongue, it is stated that "this instrument is thrust out

from side to side; and when charged with food, it is withdrawn into the stomach, unloaded, and again put forth." Mr. Peach says: "The mark left on the face of the rock coated with a film of fine sea-weed after grazing resembles the track of a sea-worm."* After long and close watching I never could see it thrust out its long tongue from side to side, and I am strongly impressed that it never does so. That part of the tongue that lies behind the lips, and which is never protruded beyond them, appears to be the only portion applied to the cropping of the filamentous algæ while browsing.

The portion of the tongue lying in the mouth is furnished with rows of strong, curved teeth, getting weaker as they pass downwards; and near the end the tongue becomes transparent, and the teeth almost indistinguishable and ill-fitted for cropping and gathering in the food.

When the animal is out browsing it moves on slowly, turning slightly from one side to the other, much in the manner of a cow grazing. At such times the teeth on that part of the tongue lying in the mouth are seen rasping on the side of the vessel, and every stroke they make is heard so distinctly on the glass as to be counted with ease. These were found, after careful trials, to be from 38 to 42 in the minute. The browsed marks made are very irregular; sometimes patches the size of a sixpence or a shilling cropped quite clean as if swept off by the lips of the animal, and other parts as if scratched by the teeth of a comb. I have no doubt that these devious tracks made by the mouth of the animal have been mistaken for the work of the long tongue stretching out from side to side and leaving its marks on the small algæ.

Forbes and Hanley say: "When the limpet moves about it makes upon the rock a curious fucoid-like track of some breadth, probably caused

* *Brit. Conch.*, iii. 232.

by the edge of the shell."* I find that whether the animal is at rest or in motion the shell is a little raised off the surface, which explains why it is so easily driven off the rock by the first blow; and if success does not attend the first attempt, it is difficult afterwards to succeed without damaging the shell. If the shell is tapped upon before being disturbed, it is seen to jerk down on the rock, closing up the intervening space. From this we may infer that it is more likely that the fucoid-like tracks were caused by the teeth of the animal cropping the algæ than by the edge of the shell.

The elevation of the shell from the rock allows at all times a free flow of aerified water to the limpet, and affords a possible means of food getting in to it while confined to a particular spot.

When the animal is laid open the tongue is seen to stretch down and fold into a few irregular convolutions on the right side, and then double back on itself till near the head. When stretched out it is about double the length of the shell, but varies more or less in different individuals.

In regard to the boring or excavating powers of the limpet, Dr. Jeffreys says: "Mr. Anderson of Wick (the highly intelligent editor of the 'John O' Groat Journal'), gave me some pieces of Old Red sandstone from that coast, in which the pits made and inhabited by *P. vulgata* were so deep, that little more than the crown of the shell was visible outside."† In this case I suspect that there has been some mistake. All round the coast of the Firth of Clyde where sandstone has been weathered into cup-shaped cavities of various sizes these are numerously inhabited by the limpet. Among hundreds of these animals found in such cavities, it is not difficult to find some whose shells fit the cavities very exactly. I have searched over considerable tracts of the shore, and often found limpets closely fitted into such holes; but on closer

* *Brit. Moll.*, ii. 425. † *Brit. Conch.*, iii. 231.

examination I could never find evidence that the hole was made by the animal, but rather that it had sought lodgment in one of the ready-made cavities.

Lower down on the tidal belt, where the sandstone is smooth, being less exposed to the weather, the limpets had made little, if any, impression on the rock.

When we reflect on the growth of the shell, and the habit of the limpet in frequently changing its position, it is difficult to see how the animal could excavate down into the hard rock till the crown of the shell was scarcely seen. Every new extension of the shell would require to open out a new and wider circle of the rock. It is difficult to see how such a pit could be made while the shell continued to grow. True, there is a limit to the growth of the shell; but does it wait till that limit is reached?

Dr. Jeffreys states: "Should the rock be soft, it scoops out by degrees with its muscular foot a cavity of greater or less depth."* This is on condition that the rock is soft, a condition not required if the limpet can excavate the hard Old Red sandstone. But without possessing any such power, it is in no way surprising that it should make impressions on soft rocks, such as chalk, &c., with its strong adhesive foot, carrying more or less of the loose crumbling material in the course of its frequent shiftings.

Reaumur found that the limpet could sustain a weight suspended from the shell of 28 to 30 lbs. for some seconds; less weights failed to overcome the resistance. Such viscosity would be a powerful means of carrying away any portion of the rock which had become weak in adhesion. The query may be put: Should the natural habits of the limpet entitle it to be considered a borer, in the true sense of the word, further than in consequence of its strong adhesive foot shifting so frequently off

* *Brit. Conch.*, iii. 231.

and on the same spot? There can be little doubt that any other mollusc, applying its soft parts in the same manner on the rock as constantly, would have the same result. Mr. J. C. Hawkshaw says: "I notice signs that limpets do prefer a hard smooth surface to a pit in chalk. On one face of a large block over all sides of which limpets were regularly and plentifully distributed, there were two flat fragments of a fossil shell about three inches by four inches embedded in the chalk. The chalk all round these fragments was free from limpets, but on the smooth surface of the pieces of shell they were packed as closely as they could be. . . . . I noticed another case which almost amounted, to my mind, that they prefer a smooth surface to a hole. A limpet had formed a clearing on one of the seaweed-covered blocks before referred to. In the midst of this clearing was a pedestal of flint rather more than an inch in diameter standing up above the surface of the chalk. It projected so much that a tap from my hammer broke it off. On the top of the smooth fractured surface of this flint the limpet had taken up its abode. The shell was closely adapted to the uneven surface, which it would only fit in one position. The clean surface below was in a hollow with several cavities where the limpet could have found a pit ready made to shelter in, yet it preferred after each excursion to climb up on the top of the flint, the most exposed spot in all its domain."* This shows very decidedly in this case that the limpet prefers a hard surface to a soft one; and one would scarcely think it would select a hard flint to bore in.

I find on the sandstone rocks that when the animals get larger they seem to have a tendency to go lower down, and the shells get less jagged on the edges. As they reach a well-matured size they become thicker and plainer on the edges, and in consequence it becomes more difficult to find a sur-

* *Journ. Linn. Soc.*, xiv. 410.

face sufficiently flat to accommodate the increased size of the shell, which seems to induce the animal to seek a smoother surface nearer low water, where the rocks are kept well polished by the constant action of the sea and debris washed against them. This tendency has been well observed by the Rev. A. M. Norman, quoted by Dr. Jeffreys: "It will be found to be a general rule with regard to the limpet, that the nearer high-water mark the shell is taken, the higher-spired, more strongly ribbed, and smaller it will be; and that the lower down it lives, the flatter, less ribbed, and larger it becomes."*

* *Brit. Conch.*, iii. 240.

II.

EXPERIMENTS WITH CHILIAN SEED-POTATOES—Report for 1883.

BY THOMAS KING.

[Read 18th December, 1883.]

In November, 1882, I read before the Society a paper giving an account of some experiments made during the preceding season with Chilian potatoes. I will now give a similar Report for 1883.

You may remember that the object I had in view was to find potatoes that would resist the attacks of *Peronospora infestans*, the fungus of the potato-disease, and that I thought this could be accomplished by importing seed-tubers from Chile, a country never visited by the disease. Accordingly, in 1882 I had some sent to me from the south of Chile, where the weather is somewhat like our own. I received no name with them, but they were red-skinned, and were said to be a good sort.

They produced strong, healthy-looking plants, but these were not disease-proof. In some cases they perished almost entirely, and in others they were but slightly, if at all, affected. One fact, at least, was now clearly established: that plants raised from healthy tubers, with no hereditary taint, might succumb to the disease if grown among diseased plants. Still, I did not consider the trials conclusive on all points, as they had been made under unfavourable circumstances. Though the tubers had arrived in good condition, they had been dug when only half-grown, and were also too late in arriving. Some of the lots were not planted till the beginning of June, and the summer turned out cold and wet.

The produce of this first lot (1882) was kept and planted last spring; and, in addition to these, I re-

ceived, in March, 1883, a second lot of about two stones direct from the north of Chile. My brother obtained them in the market-place of the village where he lives (Carrizal-Bajo), but they had been grown on irrigated ground at Huasco, S. lat. 28°, a few miles to the south of Carrizal. Some were boiled by him and found to be good. They arrived in good condition, and were pretty, clean-skinned, dun-coloured potatoes, some round, some long, and apparently quite ripe. The variety is that used for making potato-flour and for exporting to places on the coast, and is named "Borajilla," which may be rendered "borage-leaved."

As to results, I may first give an account of the lot I had the best opportunity of watching. I had nine short drills—seven of the first lot, and two of Borajilla—planted in a border at Innellan early in April. The soil, which is rather stiff, had been well manured in winter by having sea-weed dug into it. It got no other manure; but a good deal of sea-sand was put into each drill, and the potatoes were planted in that. They grew freely, and it was a pleasure to look at their fresh, broad, green leaves; but in August, after some cold, wet, stormy weather, I observed on both sorts the woolly spots caused by *Peronospora infestans*. These, however, were not very plentiful, and I had to look about for some time before I could get a few good patches to put under the microscope. Still there was enough to show that even the Borajilla, with everything except the weather in its favour, was not disease-proof. I did not see them again from the end of August till the end of October when I dug them, the shaws by this time having become quite withered. As to the crop, there were plenty of potatoes, but these were mostly small, our season having been either too short or too cold for them; and as to disease, there was very little,—so little indeed that if this had not been an experiment specially directed to disease the amount would

scarcely have been worth mentioning. As to the quality, some were cooked and found to be soft, like the "American rose," but very white, and of a fine delicate flavour.

I said that in this plot there were two sorts, the red, and the dun or borage-leaved. When they were planted I thought them distinct, but when they grew I could see no difference in leaves or flowers, or in the tubers when dug, so that probably the first lot (1882) was the same as the second (1883), the difference of colour arising from a difference of soil.

I will now give the results obtained by other growers; and here I express my thanks to all who have kindly co-operated with me in making these experiments. The only thing I had to do was to furnish the seed, while they grew it and let me know the results.

Mr. Matthew Rodger Latta, Carmyle, planted a stone of the first kind and a few tubers of the second in the middle of a large field of potatoes, where they were treated like the rest. I saw them on the 1st of September, and there was then no disease on them, or, indeed, on any part of the field. In November I saw the potatoes after they had been dug; and they had the same drawback as mine at Innellan,—they were not full-grown. Mr. Latta had not observed any of them to be diseased.

Mr. Finlay Bell planted a similar quantity on his farm at Monkton. The plants were straggling, the tubers were numerous, but small, and their quality so bitter as to render them uneatable. There was, however, no disease. Mr. Thomas Howie, Orangefield, Monkton, planted some of both sorts with the following results. There were plenty of potatoes at the shaws, but so small that most of them went through an inch riddle; and as to the quality, Mr. Howie says: "We boiled some for dinner one day, but had to want potatoes for once as they were not eatable." There were a few diseased ones

among them, but not more than one at every two or three shaws.

Mr. John Barbour, Farmer, Risk, Lochwinnoch, who planted a stone in May, 1882, planted the produce of that lot last spring, and also about half-a-dozen tubers of the borage-leaf which I sent him early in April. The crop has turned out small. The potatoes are numerous enough, but the largest are only about the size of a hen's egg. The quality, however, as a table potato, is much better than last year, but the number diseased is rather greater.

Mr. Boyd, our Secretary, kindly asked his friend, Mr. Thomas Brown, Ardneil, West Kilbride, to try a few. I sent both sorts in March, and last week received the following report:—

"Ardneil, West Kilbride.

"DEAR SIR,—I have to-day sent to your address a small sample of the Chilian potatoes. They are rather small, but the season was one of the worst we have seen for experimenting with potatoes. They grew on good, red soil, but on a high field. They got no solid manure but a good dressing of bones and guano,—a similar quantity to some Walker's Earlies and Champions that grew alongside,—and they were a fair average crop. I consider that your potatoes have not had a chance to test them this season; but I intend to put them on a low field next season, and give them a quantity of sea-weed or farm-yard manure, when I hope to be able to report more favourably to you. They had good strong shaws when growing, seemed to be ripe when lifted, which was in the end of October, and had little or no appearance of disease. I think after a year or two of cultivation the potatoes will improve materially. The high-coloured one (the first lot) seems to have done best. If you have any of the pale variety (Borajilla), you might send me a few for next season.

"I am, Dear Sir, Yours truly,

"THOS. BROWN."

All the lots I have mentioned, except the first, were grown in the field. I will now give a few cases of garden cultivation.

Mr. Boyd had some planted in his garden at Seamill, West Kilbride, in a sunny border with a southern exposure, — a perfectly sheltered spot, where the soil, although light, is in constant cultivation, and very productive for growing vegetables. "The potatoes were planted on the 26th of March, at which time the darkest sort weighed 1¼ lbs., and the lighter (Borajilla, 1883) 1 lb. 3 oz. They were dug on the 13th November, when the dark sort weighed 11 lbs., and the light 6 lbs. The disease was nothing to mention, I could only say it was there. I do not think it was worse in the one than in the other. By the time they were dug they should have been ripe; but there were a good many small potatoes in both, the largest kind, however, having the best-sized potatoes."

Mr. Low had some grown at Monifieth, Forfarshire, with the following result:—

"Chilian potatoes, planted April 17th, dug October 22nd.

"I.—Seed direct from N. Chile, March, 1883 (Borajilla). Some large, others rather small.

"II.—From tubers grown at Pollokshaws from unripe seed received from Chile, 1882. Not generally large, but beautifully shaped, and all large enough for seed; a few very large. The number at each root was counted and ran from twenty up to thirty.

"III.—From one tuber of the first lot grown at Rugby and cut in two—4 lb. 6 oz. of beautiful tubers, very few small.

"Not perfectly ripe when dug, but not one diseased."

Mr. Buchanan, 34 Steeple Steet, Kilbarchan, sent me to-day the following report: "Planted end of March, Chilian potatoes. Ground was workable and seemed safe for potatoes, but four days afterwards we experienced severe frost with N. and N.W. winds. Put in at same time 'Red-bogs' for main

crop. Ground—a dry, deep, sandy soil, with southern exposure—was well manured previous autumn, and had not been used for potatoes for three years. These circumstances caused me to anticipate a favourable result. The settings germinated well and evenly, without, I think, a single failure. The 'shaws' were exceedingly strong and vigorous, but the tubers were slow and late in forming. Dug at Hallowe'en and found the crop productive, but the half of them were much under the 'settings' in size. This I attribute partly to the earth being drawn too high up the stems, as the 'Red-bogs' had the same fault though in a less degree. I found about one-eighth diseased; the 'Red-bogs' were quite free of it, but they were all used by September. Boiled a few and considered them soft and greenish, resembling immature potatoes."

I will now make a few remarks on the experiments generally: 1st—In all cases the tubers were numerous enough but small. I suppose the plants have not yet adapted themselves to their new conditions. 2nd—Those first imported have produced a larger crop than those imported last spring. I believe the reason for that is that the first lot have had a year longer to accustom themselves to this country. I may here mention a case that seems to have a bearing on the subject of change of country. A sea-captain, who had just brought his ship from Australia to Chile, gave a few Australian potatoes to my brother. He planted them in his garden, and grew them by irrigation. The shaws were good, but when dug the crop was nothing to speak of. The change from Australia to Chile, or from Chile to Scotland, is apparently too great to be made at once. The potato is quite unsettled and thrown out of its old habits, and it then takes several years to adjust itself to its new environment. I hope that my friends who have already tried the Chilian potatoes will persevere for a year or two longer to see what they may grow to.

These enquiries and experiments, besides being interesting in many ways, have enabled us to establish two facts: 1st—That in one at least of the native countries of the potato, Chile, the disease has never been known, and potatoes are there quite healthy. 2nd—That these healthy potatoes, when grown in this country, are not disease-proof. If, therefore, we have not discovered what will prevent the disease, we have at least discovered what will not prevent it.

Apart from these experiments, I may remark that the future of the potato crop is at present more hopeful than it has been at any time since 1845, and growers are not now working in the dark. Many new varieties have been raised from the seed in the "plum," and some of these are only very slightly affected by disease. Mr. Latta tells me he loses very few potatoes, as he plants only good sorts; and another farmer, who this year had lost by his "Victorias" and "Regents," said to me that he did not intend to plant any more of these varieties. If only good sorts were planted, and the best methods of cultivation and storing adopted, I think it is not too much to hope that we may yet reduce the potato-disease to a botanical curiosity.

III.

ON THE ORIGIN OF THE FORMS OF GALLS.

BY P. CAMERON, V.-P.

[Read 28th August, 1883.]

THE question of the origin of galls has occupied the attention of observers of Nature from the earliest times. It is unnecessary for me to discuss the theories promulgated prior to the appearance of the work of Lacaze-Duthiers,* for they have now only a historical interest. The views of the eminent French Naturalist just mentioned have been generally accepted † in this country as affording a satisfactory explanation of the origin of galls; but as they are, I believe, erroneous and not in harmony with recent researches, I propose to state here my reasons for believing them to be not in accordance with our knowledge of the origin and growth of galls.

Lacaze-Duthiers' theory was briefly this: His own admirable researches into the morphology of the ovipositor of insects had shown him that gall-flies had, in connection with their ovipositor, a gland, which, in the bees and wasps (which belong to the same order as the gall-flies), undoubtedly secreted a liquid of a poisonous nature. He therefore argued that galls owed their origin to the liquid which was deposited by the flies in the tissue of the plant along with the eggs. To account for flies scarcely distinguishable from one another, producing quite dissimilar galls, it was further assumed that the poison varied in its chemical and molecular constitution in each species. Each species, in fact, had,

**Annal. des Sc. Nat. Bot.* (3) xix. p. 273, *et seq.*

†See Darwin, *Animals and Plants under Domest.*, ii. p. 273; Lubbock, *Nature*, vii. p. 448.

according to the French Naturalist, a poison peculiar to itself, and it was by virtue of this peculiarity that each species invariably raised galls of a specific description. Lacaze-Duthiers did not make any investigations into the nature of the liquid secreted by the gland attached to the ovipositor in the gall-flies; and the only fact which he adduces as showing that there may be a difference, is that the poison of different bees and wasps is not of the same strength with all of them; for some species sting much more severely than do others. He compares the secretion to vaccine matter; just as when the contagium of, say, small-pox, is introduced into the human system, it invariably produces small-pox and not scarlet fever; so the poison of *Cynips Kollari* always gives origin to the well-known marble-galls and not to oak-spangles or oak-apples.

This view of the specific nature of the secretion has been strongly supported by Sir James Paget, the well-known pathologist. He says: "In these and other similar diseases in plants we have, it seems, hundreds of specific diseases due to as many hundreds of specific morbid poisons; for the most reasonable, if not the only reasonable, theory of these diseases is, that each insect infects or inoculates the leaf or other structure of the chosen plant with a poison peculiar to itself. The poison may be merely deposited; but, in the instances best fitted for study, it is inserted in the plant itself, whether leaf or any other, and the wound for inserting it, the poisoned wound, may be made either with part of the oral apparatus, or, as in most of the true galls, with the ovipositor, through which one or more eggs are passed with the virus, and are left among actively living structures of the plant. The little wound closes, the virus, whether an oral or an ovarian secretion, remains, and the result of its influence in the plant structure and their contained protoplasm is the formation of the gall or other morbid products." Again: "We find hundreds of

different forms of galls, and we may be nearly sure that there are as many kinds of morbid poisons produced by gall insects, each form answering to a different virus."*

It is certain that there is no positive evidence tending to show that the implied differences in the composition of the secretion actually exist, while the comparison of it with contagia is purely analogical; for the latter are not poisons secreted by glands, but specific organisms which cause diseases by their multiplication in the animal system. Neither can any confidence be placed in Lacaze-Duthiers' argument deduced from the venoms of different bees or wasps being of different strengths; for, to say nothing of the fact that the gall-flies belong to a section of the *Hymenoptera* which uses the ovipositor, not as a weapon of offence or defence as do the bees and wasps, but entirely as an egg-laying instrument; there is undoubted evidence that the secretion is not at all of an irritant character. Beyerinck † describes it as tasteless and smell-less, and as a substance which, when injected under the skin, produces no ill effects, while the venom of bees or wasps, when introduced in the same way, tends to the same results as if it had been inserted by the insects themselves. And the concurring testimony, based not on hypothesis, but on direct observation of several observers, shows that the use of the secretion is to close up the hole made by the ovipositor. In another great group of gall-makers—the dipterous family *Cecidomyidæ*—there can be no question of the poison being the gall-raising agent, for their ovipositors are quite incapable of wounding the plants.

There is clear evidence, so far at least as the *Cynipidæ* are concerned, that neither the above-

* *An Address on Elementary Pathology*, delivered before the Medical Congress at Cambridge, 1880.

† Beyerinck, *Beob. ü. die ersten Entwicklungsphasen einiger Cynipiden Gallen*, p. 186.

mentioned secretion, nor the wound made by the ovipositor when the eggs are laid, has anything to do with the growth and formation of the gall.* It may be two or three weeks, or two or three months after the eggs were laid before the gall commences to grow; it then only does so when the larva has left the egg and has begun to feed, the formation of the gall being synchronous with the birth of the larva. Thus it is evident that the irritation caused by the feeding and growth of the larva must be regarded as the main, if not the exclusive factor, in the formation of the galls of *Cynipidæ*.

Before any gall-growth can take place it is absolutely necessary that the eggs should be deposited in the cambium-layer of the plant. It is easy to see why this should be so; for the cambium-layer is the seat of active growth in the plant; it is composed of formative, not of formed matter, and hence we can readily perceive why it so susceptible of stimulation from foreign influence. The more active the growth in the cambium-layer it might be expected that it would be the more susceptible to external irritation, and that the growth of the galls would be most rapid when the layer itself was at its most active period. This is precisely what we find to be the case. The spring galls reach maturity and even decay in two or three weeks; eggs laid in the leaves in summer take much longer—some two or three months—to become fully grown; and still slower is the development of the bark and root galls.

The action of the larvæ on the galls is well shown by the inquiline flies. These lay their eggs n the galls when they are quite young; their larvæ are quicker in growth than those of the gall-makers, and they soon monopolise the gall, distorting it, and often converting a monothalamous nto a polythalamous gall. One of the best

* It must be understood that this paper deals only with the galls of the *Cynipidæ*.

instances of this kind is found in *Periclistus caninæ*, which inhabits the gall of *Rhodite centifoliæ*, increasing its size by nearly one-half, and forming numerous cells inside, while it would have been a roomy shell tenanted by one larva if the proper tenant had been left undisturbed. Certain galls, too, can be detached from the plant when half-grown, and, if supplied with moisture, will grow as well as in their natural position.

It must, however, be mentioned that the above view—of the action of the larva as being the most potent agent in causing the growth of galls—applies only to the *Cynipidæ*. In the *Tenthredinidæ* the larva certainly has nothing to do with the formation of the gall, which is fully formed before the larva quits the egg. Here the only agencies at work are the irritation made by the saw-like ovipositor, and by the egg, which increases in size considerably after being placed in the plant. It is true that there is a liquid deposited in the wound along with the eggs, but there is not the slightest doubt that its function is to close the wound. It is laid by all *Tenthredinidæ* along with the eggs, and in some cases it apparently prevents the wound from closing in on the eggs and crushing them.

In connection with the *Tenthredinidæ* the question naturally arises how one species raises galls, and another, which can hardly be distinguished from it, does not do so, both depositing their eggs moreover in the leaves. I believe the answer is that the former lays its eggs in the cambium-layer and the other does not.

The poison, or, as it might be termed, the infection theory, as we have seen, accounted for the forms of the galls by the specific nature of the secretion. How can we explain, on the larval irritation theory, for each species always having a particular gall of its own? Many gall-flies, which give origin to most diverse galls, are not distinguishable, and all of them in the same genus

resemble each other very closely. It is true that some of them have longer or shorter ovipositors than others, but this has reference solely to the situation in which the eggs are laid. There is no appreciable difference either between the larvæ, which, as has been explained, are the most active agents in causing the galls to grow. I am not aware of any variation in their manner of feeding; they all feed on a particular layer of the gall, that, namely, which surrounds them—a layer of cells containing much starchy matter. I believe, however, that we may explain the forms and structures of galls by reference to well-known principles.

Consider what exists with external-feeding larvæ. These have many enemies; they are preyed upon by birds, reptiles, and carnivorous insects of all sorts, while there is the enormous army of ichneumons ever ready to lay their eggs in their chosen victims. To guard against these insidious foes, we find that some are uneaten by birds owing to their bodies containing noxious secretions, or by being covered by stinging hairs, while many have peculiar habits which enable them to escape danger. Large numbers escape death by their bodies imitating the surroundings, animate or inanimate. This is not mere theory; the facts I have stated can be proved beyond dispute, and are independent of whatever views we may hold as to their origin.

Now apply the same reasoning to the elucidation of the forms of galls. The gall clearly stands in the same relation to the gall-fly as does its skin to the external-feeding larva. The gall-larva is perfectly passive; it is hidden, and, therefore, there is no use in itself bearing the protecting spines and hairs found on so many external-feeding caterpillars; neither can their bodies assume particular shapes so as to elude, in this way, the keen eyesight of the ichneumons. If the larvæ are to escape they can only do so by the galls themselves being

modified; and observation shows that they are provided with numerous contrivances for the better protection of their tenants.

Gall-insects are preyed upon by numerous insects. Some live in the galls, feeding on the gall structure, ousting, cuckoo-fashion, the legitimate owner, which is killed; many feed on the larvæ. Now the gall-larvæ can only feed when the galls are soft and juicy. The spring galls, as a rule, are always in this condition, but then the larvæ feed up very fast and become perfect insects in a very short time. The autumnal galls, on the other hand, have a much longer duration. At first they are soft, as must of necessity be the case if the larva is to feed; but after it has become full-fed the galls turn quite hard, if not woody, in texture. It is evident then that if the parasitic or inquiline flies are to obtain a footing in the galls they must attack them when in their soft condition—for their ovipositors are unable to pierce the hard woody galls, while the cuckoo-flies can, like the gall-larvæ themselves, only eat the galls when in their early soft state. To protect the gall-flies at this period we find numerous contrivances. Many are minute and not readily seen; so as to make them less visible the catkin-galls assimilate in colour with the catkins, being greenish when young, and brownish when old. The pilosity on some of them, *e.g.*, *Andricus pilosus*, adds to their resemblance to the catkins. A few are concealed in the leaf-buds, *e.g.*, *Aphilothrix collaris*, where they can scarcely be noticed. There is no doubt also that the practice of some of the softer galls of dropping to the ground, after the larva has reached maturity, is a valuable aid in protecting it; for it reduces greatly the time during which it is exposed to attacks. These galls also when on the tree are green, but before falling become dark in colour, and thus are hidden effectually on the dark soil. The galls of *Neuroterus* again do not become fully developed

when they are attached to the leaves on the tree; it is only when they reach the ground that the larva and the gall become fully grown. The very small size of many galls must afford them some protection, for there is little inducement for inquiline flies to lay their eggs in them, the gall only affording nourishment to a single larva. On the other hand there is not the slightest doubt but that the large size of some of the galls must be of the greatest use as a protection to the larvæ. In the case of the large monothalamous galls, the larva merely requires the central layer for food, and this layer, too, is of a very strong texture. The larva is protected by a layer of from two to three lines, or even half an inch or more according to the species, and this must be pierced by the parasite before it can reach its victim—and hence the ichneumons with short ovipositors are precluded from attacking them. In a small gall, if a cuckoo-fly deposited its eggs in it at the proper time, the tenant was certain to be killed, but the large galls may afford food for both. I do not mean to say that this is always the case, but I have more than once reared both the gall and the inquiline flies from the same gall. I have observed that the *Synergus* —the cuckoo-fly—lays its eggs in the galls of *Cynips Kollari* while the latter was very young, and in this case it would doubtless kill the *Cynips*, but if the eggs had been deposited later on both species might have reached maturity. It is, in fact, a most interesting subject to trace how the parasitic and inquiline flies have had their bodies and their habits modified so as to enable them to prey on the gall-flies—the former so as to enable them to reach into the centre of the large galls—the latter so that they may appear at the only time when they can attack with any advantage, *i.e.*, when the galls are soft.

I have already stated that the pilosity on some galls serves to protect them by assimilating them

better with the catkins. In other galls this pilosity becomes enormously developed and covers the gall or galls with a thick matted clothing, which, when young, is frequently more or less glutinous and must thus serve as a protection. Other galls not provided with hairs are covered with a gummy secretion which, one would think, would be apt to entangle insects. In the case of *Aphilothrix Sieboldi*, as Dr. Adler relates,* this glutinous matter indirectly protects the gall-flies in another way; for it is much relished by ants, which cover them with earth and sand so as not to be entangled themselves when getting the liquid. I have myself noticed the ants on the galls of this species, and a similar case has been discovered in America.

The gall-flies again—and especially the larger ones—are apt to be preyed upon by birds which dig out the larvæ from the galls. The large size of many galls—*e.g.*, *Cynips hungarica*—must here be of use; but the larvæ, as well as the flies, have a better protection from birds in their bodies giving out a nasty smell, and we may therefore presume that they do not taste very nicely. *Cynips Kollari* is a case in point. I have noticed in several localities that, when it first appeared in them, it was more or less preyed upon by the tom-tits, but after the first season they are scarcely touched. *Dryophanta foli* has quite a nasty smell. When these large galls get a month or two old the portion next the outer skin and the central chamber becomes more or less friable; it must also be of rather an astringent nature, and scarcely agreeable to the bird which gets (as it must do) some of it in its mouth when piercing the gall to reach the larva. Of this nature are the celebrated "Dead Sea apples" of the East—"which tempt the eye, but turn to ashes on the lip."

Thus we discover precisely similar phenomena among galls to what exists with external-feeding

* *Zeits. f. wissensch. Zoologie*, xxxv. p. 172.

larvæ, and if the explanation accepted by entomologists in elucidating the origin of the forms and colours of larvæ—that these serve to protect them, and have been produced by the agency of natural selection—is a valid one, I do not see how we can reject it as explanatory of the forms, colours, and structures of galls. It is at any rate more in harmony with general laws than the poison theory, even although it had more to support it than has hitherto been adduced.

IV.

ON THE HABITS OF EUURA (olim Cryptocampus).

BY P. CAMERON, V.-P.

[Read 27th November, 1883.]

THE immortal Swedish Naturalist De Geer was the first who described the economy of any species of *Euura*. He gave* a full account of the species now called *Euura pentandræ*, so named from its frequenting the willow *Salix pentandra*. This species forms large, irregular, woody galls on the young shoots; in size they vary, some being not much larger than a small cherry, while others reach the size of a large walnut. They are essentially medullary galls, that is, they take their origin in the pith, the swelling gradually extending to the woody portion of the twig. When fully formed they consist of a spongy central mass representing the pith, and of a larger outer wall of woody matter, composed of very much distorted cells. Inside of this formation the larvæ live, feeding chiefly on the pithy cells, and to a less extent on the inner part of the woody stratum. Several larvæ live in a single gall; the largest number I have noticed was seven, the smallest, two. The cocoons are spun in the centre, among the debris of the pith and frass, and in these cocoons (which are formed in the autumn) the larvæ remains unchanged till the following May, when they moult, become pupæ, then in fourteen days or so enter the perfect state, emerging from the galls in June. The same, or a very closely allied species, forms similar galls on the poplar.

The habits of the other two recorded British species, *angusta* and *saliceti*, appear to be but very

* *Mémoirs*, ii. p. 271, No. 24, Taf. 39, Figs. 1-11.

imperfectly known, so far as their life-history is concerned. Both of them have been reared from willow twigs in which the larvæ had passed the pupal state, the twigs being hollowed out for about one inch, and their vitality, to a certain extent, destroyed. That they do not feed on the pith is, I think, certain; and Mr. Edward Saunders has bred *E. saliceti* from a bramble stem, the cocoon having been spun about one inch from the end of the broken branch. As with this bramble stem, it is generally only in those willow twigs which have their points broken off that we find the *Euura* larvæ.

I have been able this season to work out the life-history of what is apparently an undescribed species.* In May or June this species lays its eggs in the leaf-buds of *Salix caprea*, in those buds, namely, which are to give origin to the leaves of the following year. Inside of these the larvæ live solitarily; the buds become enlarged, somewhat longer than they are when about to burst in spring, and more than double the size of the natural buds found on the tree at the same time. There is no apparent change in the form of the bud, nor in the outer skin. Next to this, however, is a firm layer of a green substance, and the rest of the gall is taken up with a bright green granular matter on which the larvæ feed. Towards the end of September or in October the larva leaves the gall-buds, making, as it does so, an irregular, comparatively large hole in one side and close to the top; creeps on to the twigs, and, if it finds one with the end broken off, bores into it for an inch or so, remaining there, in its cocoon, till the next summer. If no suitable twigs are available it drops to the ground.

It is worthy of note that in the United States of America there is a species of precisely similar

* In my *Monogr. Brit. Phyto. Hym.* ii., I have described it as *E. nigritarsis.*

habits—namely, *Euura orbitalis*, Norton. Walsh, the describer of its habits, says: "The gall is the lateral bud of a twig enlarged so as to be twice or thrice as long and thick as the natural bud before it begins to expand in the spring, otherwise externally unchanged. Internally it contains early in the autumn a homogeneous grass-green fleshy matter which is afterwards consumed by the larva, leaving nothing at last but a mere shell as thin as paper, and partly filled with excrement. The gall is monothalamous, sometimes one only on a twig, sometimes three or more at irregular intervals—rarely as many as three or four found out of three or four consecutive buds." *

In this last respect our native species does not agree with the American. I have found several long twigs with every bud converted into a gall. In Mugdock wood there are several willows *(Salix caprea)* which will bear no, or at least very few, leaves next year, for all, or nearly all, the buds have been killed, and in all probability these bushes are more or less permanently disabled. Indeed, before I discovered the insect which ate out the buds, I used to be puzzled to account for so many willows being killed outright, or certain of their branches only.

Similar gall-buds are found on *Salix aurita*, and as *Euura saliceti* has been bred from the twigs of that plant I have no doubt that further investigation will show that it lives in the buds, only boring into the twigs to become a pupa. I can, indeed, adduce some evidence in support of this view. On the Kilpatrick hills I found a small bush of *Salix aurita* the twigs of which had been very much bored by the larva of *E. saliceti*, and many of the leaf-buds were eaten out and enlarged. In one or two buds I observed that the larva had penetrated from the bud into the stem, where it had spun its cocoon quite close to the gall.

* *Proc. Ent. Soc. Phil.*, vi. p. 250.

Whether this habit of boring into the stem without leaving the gall is a common one or not, I cannot say in the meantime.

From what I have said above it will be seen that the bud-inhabiting species must be reckoned among our injurious insects. *E. pentandræ* is also a destructive species. I have more than once seen it destroy completely young trees of the sweet-scented willow; every twig would bear a number of galls, and the total number on one tree I observed must have been between two and three hundred. By their action the life-blood of the plant was sucked out and the twigs distorted in every direction.

In Cadder Wilderness I have found in September the leaf-stalks of *Salix caprea* swollen to more than double their normal size, the swelling extending from the base to where the leaf itself commences. This gall is inhabited by a larva of an *Euura*, which, although I have not yet bred it, I have no doubt is *E. venusta*, Zaddach *(Beob. u. d. Arten d. Blatt—und Holzwespen* (2), p. 6). The petiole is eaten out by the time the larva has reached maturity, and it leaves it by making a large hole in the side.

V.

ON THE OCCURRENCE OF MICRODON MUTABILIS, LIN., IN THE WEST OF SCOTLAND.

BY P. CAMERON, V.-P.

[Read 27th November, 1883.]

At Ballantrae, Ayrshire, I found last year in a nest of the Common Ant, *Lasius niger*, situated in the stump of an old tree, a curious object, which, when I first saw it, and before examination, I took for a slug. It was elliptical, brownish-grey in colour, flat on lower side, the sides of the ventral surface ciliated, the back reticulated, convex, and bearing anteriorly two projecting horns (which are the processes by which they breathe). A note by Laboulbène (*Ann. Soc. Ent. Fr. Bull.* 1882, p. 118 and p. 128) gave me some indication as to what the creature was, and the finding of more specimens during the spring of this year near Glasgow, enabled me, by the aid of a paper by G. A. Poujade (*Ann. Soc. Ent. Fr.* 1883, p. 23, Pl. 1), to recognise them as the larvæ and pupæ of the fly *Microdon mutabilis*, Lin. All that seems to be known about the larva is that it is always found in the nest of the above-mentioned ant, that it is generally found in the lower galleries, and that before turning into a pupa it goes near the surface. The larvæ, I observed myself, were resting motionless, and adhered closely to the sides of the gallery, from which they were only with difficulty removed. No one has ever noticed them feeding in the nests; the ants pay little or no attention to them, so it would appear that they are not injurious to their hosts; and few of the larvæ are found in one nest. The group of

the *Diptera* to which *Microdon* belongs—the *Syrphidæ*—feed during their larval existence on plant-lice; and as the black ant keeps aphides in its nest it is possible that the Dipteron may feed on them; but if so, it is certainly very curious that the ants would tolerate their presence in the nest, as they are very careful in looking after their aphides, on the excrement of which they feed. Poujade even suggests that they may feed on the ant larvæ, but the same objection as that urged against their feeding on the aphides applies equally well here.

VI.

A FEW NOTES ON THE MAMMALS AND BIRDS OF ROUSAY, ONE OF THE ORKNEY ISLANDS.

BY T. E. BUCKLEY, B.A., F.Z.S.

[Read 29th April, 1884.]

Of all the districts of Scotland, the Orkneys seem to be the one which has had of late years the least attention paid to its zoology, or at least to those branches of it that I have mentioned at the heading of this article. No doubt there are plenty of notices scattered here and there through natural history journals, such as the *Zoologist*, on certain rare or infrequent visitors to these islands; but no Gray or Saxby has arisen to do for them what these excellent naturalists have done for the Hebrides and Shetlands. This is the more to be regretted, as agriculture is advancing with such rapid strides as bid fair soon to improve all the heather and wild places, such as the more interesting species delight in, off the face of the country. Forty years ago the greater part of the mainland, as the large island of Pomona is called, was mostly heather, the cultivated portions being those nearest the coast; now some of the hills are cultivated nearly to their very tops; draining is also another very potent aid in driving away the waders and water-fowl; and last, but not least, the insatiable desire shown by all the inhabitants, young and old, to take every egg, no matter what, that is large enough to make it worth their while to cook it. Still, the number of small islands, or holms, as they are called, act as guardians to a good many of those species most interesting to the naturalist, such as Eider Ducks, Stormy Petrels,

&c., as they are only visited occasionally by people who come to look after their stock, which is placed on these islands during the summer months when an abundance of grass springs up.

Rousay, one of the more important islands of the group, belonging to Lieut.-Gen. F. W. Burroughs, V.C., C.B., includes in its parish the islands of Viera and Egilshay; but it is to Rousay itself, where, as tenant of the Westness shootings, I was resident from the middle of April to December, 1883, that the following observations most apply. I have, however, introduced a few remarks on the Fauna of Orkney generally, when I could do so on good authority; but as Messrs. Baikie and Heddle's *Natural History of Orkney*, published in 1848, is still the best book on the subject, I have rather left out what I could not verify myself than follow blindly a work so out of date as this obviously is.

A few words on the physical features of the island may not be amiss here.

Nearly the whole coast-line of Rousay is rocky, rising in the north and east to cliffs of a considerable altitude, these cliffs being the home of a goodly number of rock birds so-called, as the Guillemot, Razorbill, Kittiwake, &c. From the south-east to the south-west the shore is more level, in places covered with stones mostly flat and worn at the edges. This apparently arises from the fact that the rock is very soft, and easily split into large slabs, which again break up into smaller but still flat pieces. These large slabs are much used for roofing cottages. All the seaboard is more or less cultivated, more so at Wasbister and Sourin on the north and east sides, where there is a greater extent of comparatively level ground, the moorland rising immediately behind to a height of between 800 and 900 feet.

There are some six lochs on the island, three of considerable size. Two of these, called the "Muckle" and "Little Waters," are connected by a small burn, and their united waters run down the Sourin Burn

through the centre of the island in a north-easterly direction and enter the sea at Sourin. The third is the Loch of Wasbister, which is only some 150 yards from the sea. All these contain trout of good quality and size, the Loch of Wasbister being especially noted for the beauty of its fish. The other three lochs are small, and contain no trout.

From the prevalence of the westerly winds, tree life must have always had a hard struggle for existence; and this is shown even yet by the trees in the garden. Still, in one or two places in the island remains of tree roots occur, one of these places being in a sandy bay a little to the west of Westness, where, when digging for bait for sea-fishing, I have come on them in the peat, the whole being covered by a thin layer of sand. Even the heather, where exposed to the full blast of the gales, shows their effects by growing in a stunted and very bushy form, being of little use as cover to the grouse from their inability to burrow into it: much of it, too, grows on a clayey soil, so that when once burnt it never comes up again, being replaced by grass and great quantities of thistles. In the centre of the island the moorland is like ordinary grouse-ground elsewhere, being a succession of good heather, grassy spots, and wet flows. The house of Westness stands on rising ground near the shore, and is surrounded by almost the only trees in the island, principally Sycamore and Wych-elms, which seem best able to stand the autumn and winter gales. The garden is, in the spring and summer, the breeding haunt of most of the Blackbirds and Thrushes in the island; and in the winter, innumerable Starlings roost in the trees, these attracting numerous Merlins and Kestrels—always on the look-out to cut off stragglers. Chaffinches, the commonest birds in most places, were entirely absent all the summer, only putting in an appearance as autumn came on—a most unaccountable thing, as there is apparently nothing to prevent their becoming permanent resi-

dents. Close below the house, and looking westward over to Pomona, is the Sound of Eynhallow, so called from an island of that name that stands in the centre. Once inhabited by two or three families who all died of fever, but now deserted on that account, it is given over to innumerable Rabbits and the wild-birds which breed there in quantities. Some sheep and cattle, too, are grazed there during the summer months as long as the grass is plentiful. On each side of the island the tides run with great force, forming what are called "roosts," which seem to mean merely these strong currents, and here they run at the rate of nine or ten miles an hour. Quantities of Black Guillemots build under the stones or crevices of the rocks far more than in any other place hereabouts. To the east of Westness the ground rises steeply to the hills, the heather coming down to the road at the back of the house; and to the north the Atlantic is the only thing that meets the eye.

I had hoped to have been able to record some of the more ordinary summer warblers as having occurred here, from my own personal observations; but, unfortunately, nearly the whole of October we had westerly winds, which kept the migrants from visiting us. Such observations as I have been able to make will be found below under their respective headings.

The mammals of Rousay are more conspicuous for their absence than for anything else, and perhaps the most wonderful circumstance of all is the entire absence of Rats *(Mus decumanus)*, and almost so of the *Mustelidæ*, in fact, of all so-called "ground vermin." The most abundant mammal of all is the common Field Vole *(Arvicola agrestis)*, locally known as "Vole Mouse," and the whole of the uncultivated part of the island is covered with their runs. One species of Seal is common.

MAMMALIA.

CARNIVORA.

Fam. *Mustelidæ.*

OTTER *(Lutra vulgaris).* Very common, passing frequently during the late winter and early spring up and down the burn that runs out of the Muckle and Little Waters. A few come up to the burns after the trout during the spawning season, but their great haunts are the cairns and holes along the sea-side. Being mostly nocturnal animals they are rarely seen; but their droppings and well-worn runs, which latter they make so as to cut off corners when going about the burns, are sufficient evidence of their abundance. Their skins are said to be much finer and darker than the mainland ones.

PINNIPEDIA.

Fam. *Phocidæ.*

COMMON SEAL *(Phoca vitulina).* Abundant; haunting the Weir Skerries, and the Taing Skerry (between Gairsay and Shapinshay) at low water, where they rest when undisturbed. They are extremely shy; and the three I killed, all females, had small shot buried in their blubber, which amply accounted for their wildness. The first two that I procured, at the end of June and beginning of July, had each a single young one inside, evidently on the point of being born, though of course I did not know this at the time. Their eyes were nearly open, and when taken out of the uterus the long hair, with which they are apparently clothed almost to the day of their birth, fell off.

When the summer is over, and the days get shorter, the Seals no longer adhere so closely to the Skerries, but wander along the coast.

Before a storm of wind Seals have a habit of jumping clean out of the water several times in succession.

Grey Seal *(Halichœrus gryphus)*. Very rare, and I could not be certain that I saw this seal on more than two occasions—in October and November. When in the water their heads have a more angular and sharp appearance than the Firth Seal, whose head is round like a bulldog's.

Rodentia.

Fam. *Muridæ*.

Common Mouse *(Mus musculus)*. Very common everywhere.

Brown Rat *(Mus decumanus)*. Said to have been imported at one time to Rousay; but although they increased for a little, they presently died out—the only instance on record, I should say, of this destructive beast doing such a thing. Certainly I never saw or heard of one during my residence there.

Fam. *Arvicolidæ*.

Common Field Vole *(Arvicola agrestis)*. Extremely abundant all through the island, their burrows and runs appearing in every direction. Every bird and beast seems to eat the Field Vole, and dogs devour them greedily.

Fam. *Leporidæ*.

Common Hare *(Lepus timidus)*. An introduced species, more abundant in the south-east of the island owing to stricter preservation. They are much more of a mud colour than those further south—a sort of natural protection to them, as they are not very distinct even when on the move.

Rabbit *(Lepus cuniculus)*. Scarce now, owing to incessant persecution. They were very numerous a few years ago.

Cetacea

(Odontoceti).

Fam. *Delphinidæ*.

Pilot Whale *(Globicephalus melas)*. A herd seen on one or two occasions.

Porpoise *(Phocæna communis)*. Common the year round.

AVES.

Accipitres.

Fam. *Falconidæ*.

White-tailed Eagle *(Haliaetus albicilla)*. Is said to have bred in Rousay in former years, and to have destroyed numbers of sheep when these were of the small Orkney breed: they are now only occasionally seen. One is in the possession of Gen. Burroughs, a bird of the year.

Peregrine Falcon *(Falco peregrinus)*. Seen throughout the year, though I could not hear that they bred on the island. A pair frequented the highest part of the cliffs for some time, but apparently only to prey on the sea-fowl.

Merlin *(Falco æsalon)*. Resident, a few pairs breeding through the hill. They are very abundant in autumn and winter, especially the former season, haunting the garden late in the evening after the small birds that come to roost there.

Kestrel *(Tinnunculus alaudarius)*. Resident and fairly common, a few pairs breeding in the sea-cliffs. They are rather rarer in the winter than in the spring and summer.

Common Buzzard *(Buteo vulgaris)*. One seen on 2nd November. Probably occurs regularly at the migration time.

Rough-legged Buzzard *(Archibuteo lagopus)*. Occurs probably every year during the time of migration. I saw one hovering over the hill on 1st November, and two are in possession of Gen. Burroughs at Trumbland House.

Hen Harrier *(Circus cyaneus)*. Much rarer than formerly owing to constant persecution, though a pair or two still breed. The keeper shot the male from the only nest he found this year, the hen, strange to say, never coming near. It is far from common in my experience to get the male from the

nest in the first instance, though once the female is killed he will occasionally come and take her place.

In autumn these birds are very abundant, principally young ones of the year, though I have very occasionally seen an old male, and one I observed had not quite assumed the adult dress: this was in November. Its half-grey plumage was very striking.

Old males seem to be covered with a sort of white bloom, and this, when rubbed off, leaves the bird of a darker tint. This bloom begins to be assumed the first autumn, about November.

Fam. *Strigidæ*.

Short-eared Owl *(Asio accipitrinus)*. Much commoner formerly than now; indeed, this year the keeper could only find one nest on the whole island; this contained six eggs. I believe these Owls laid a second time, as I used constantly to see a pair of birds hunting for mice, &c., in the late afternoon about July and August, at the edge of the loch where I was fishing, returning always to a certain hill where the keeper had taken the nest before. I saw none of these birds after the late autumn.

Passeres.

Fam. *Turdidæ*.

Song Thrush *(Turdus musicus)*. Very common in the spring and autumn, but getting much scarcer as autumn verges into winter. Quantities build in the Westness garden. I heard a Thrush singing here on the 29th of November, but it is rare to see one so late here.

Redwing *(Turdus iliacus)*. Not very common. Arriving with the Fieldfares, but not so numerous.

Fieldfare *(Turdus pilaris)*. A few flocks seen about the time of migration.

Blackbird *(Turdus merula)*. Common the year round: breeding, though not so numerously as the Thrush. They are, however, much commoner in the winter, a dozen at a time being often visible on the

lawn in front of the house, or in the trees about. The Blackbird feeds until very late in the evening, almost invariably chattering when he flies up to roost at night. On stormy nights they get into the closest part of some thick fir-trees, where they are not too high.

Ring Ouzel *(Merula torquata)*. Only once seen about the end of April, when I observed a pair in some low rocks on a hill-side.

Fam. *Sylviadæ*.

Hedge Sparrow *(Accentor modularis)*. Probably occurs more often than is supposed. I shot a specimen in the Westness garden on 5th December.

Robin *(Erythacus rubecula)*. Common and resident. I could not observe that their numbers increased or diminished throughout the season.

Wheatear *(Saxicola œnanthe)*. Very common from early spring until late autumn. They are very partial to the stony beaches hereabouts, perhaps attracted by the numbers of flies bred in the tangle cast up by the sea.

Sedge Warbler *(Acrocephalus schœnobœnus)*. There were about three pairs of these Warblers in the Westness garden, where they doubtless breed, though I did not find a nest myself. They kept mostly to some nurseries of young willows, and were to be heard constantly until July set in. They seemed quite indifferent to the presence of water.

Goldcrest *(Regulus cristatus)*. Occurs in both spring and autumn, and I noticed that they were shyer here than this confiding little bird generally is. There were few, if any, to be seen in the garden during the winter.

Fam. *Troglodytidæ*.

Wren *(Troglodytes parvulus)*. Resident and not rare: breeding in the garden in the same situations as in England. One nest was placed in an elder tree about twelve feet from the ground: it, how-

ever, was unoccupied; as here, just as elsewhere, "cocks' nests" are commoner than the family mansions.

Fam. *Motacillidæ*.

Pied Wagtail *(Motacilla lugubris)*. Only a few pairs bred on the island; but numbers arrived in August and beginning of September, disappearing by the end of the latter month.

Meadow Pipit *(Anthus pratensis)*. Not a particularly numerous species, though it is resident and breeds. It is very scarce in winter.

Rock Pipit *(Anthus obscurus)*. Very common and resident, breeding along the coast, and always close to the sea. I have found the nest in banks, heaps of stones, and once in nettles alongside an old wall. The nest itself is made entirely of fine grass, and contains usually five eggs, much like those of the Meadow Pipit, but larger.

Fam. *Alaudidæ*.

Skylark *(Alauda arvensis)*. Common and resident, though not very numerous; nor does it seem to sing in such a joyous manner or ascend to such a height as in England; but perhaps the comparatively cold climate of Orkney may account for this, as it was never, even in the height of summer, really hot for more than a day at a time.

Fam. *Emberizidæ*.

Snow Bunting *(Emberiza nivalis)*. First seen on 10th October, when I picked up a dead bird. A scarce bird during the winter here, probably on account of the continued mildness of the season.

Black-headed Bunting *(Emberiza schœniclus)*. Rare; only seen on one or two occasions.

Bunting *(Emberiza miliaria)*. Common and resident, breeding abundantly in the cultivated districts. A good many additions arrive in the autumn, or it may be that the residents, old and young, gather into flocks then and sit on the trees in the garden,

as they seemed more common at that time and in winter.

YELLOW HAMMER *(Emberiza citrinella).* Resident but rare, a few pairs being seen through the breeding season. I noticed no addition to their numbers during the autumn or winter.

Fam. *Fringillidæ.*

CHAFFINCH *(Fringilla Cœlebs).* Considering the number of trees at Westness, it is not a little singular that this elsewhere extremely common bird should only be a winter visitor here. The first seen were on 22nd October, and were by no means so tame as they generally are. After that they gradually got more numerous, though never very common.

HOUSE SPARROW *(Passer domesticus).* Very common, building in the ivy and in holes in the walls.

GREENFINCH *(Ligurinus chloris).* Rare, but breeds. One nest taken in Westness garden out of a mountain ash. There were two or three other pairs of these birds in the garden. Their numbers increased in autumn, but more were seen in winter.

LINNET *(Linota cannabina).* Very common in winter, numbers coming into the garden to roost. One shot on 3rd December had still some of the pink feathers left in the breast. A few pairs bred in the garden. I got two nests—one in May and the other in June, and on each occasion the old birds were well seen at the nests.

TWITE *(Linota flavirostris).* Very common and resident. The first nests were taken on the 13th of May, one of which was in some ivy. Three and four are the usual number of eggs in a nest, though they lay as many as six. The nest on the outside is generally made of fine roots, and lined with hair, wool, and feathers. On one occasion the nest was so full of wool that the old bird, in flying out, caught her foot in it and threw out two of the eggs.

In the garden they are very fond of building in the elder trees. I have often found eggs lying under the nests broken, as if thrown out by accident.

Starling *(Sturnus vulgaris)*. A most characteristic Orkney bird, being abundant and resident everywhere. Any hole, but especially the loose stone-dykes of the country, afford this bird a nesting-place, and they seem to rear two broods in the season. Very shortly after leaving the nest the young bird begins to throw out the spotted feathers of autumn, though how soon the entire change is effected I do not know. Quantities roosted in the Westness garden, and they seemed to choose the leafiest trees as long as the leaves remained. They never seemed to go straight to their roosting ground (except the very late arrivals), always first sitting on the trees nearest the walls, and then singing their evening hymn, one detachment after another doing the same thing. They are wonderful mimics. I have seen albino varieties on one or two occasions.

Fam. *Corvidæ*.

Raven *(Corvus Corax)*. There are only about two nesting-places in the Island of Rousay, one of which is inaccessible. They were by no means very numerous here, except in the early autumn, when a good many came to feed on a defunct cow not far from the house.

Hooded Crow *(Corvus cornix)*. By no means uncommon. Very destructive to the sea-birds' eggs, carrying off quantities of Kittiwakes' and Guillemots' eggs and eating them immediately above the owners' dwellings.

Rook *(Corvus frugilegus)*. There is a rookery in Kirkwall in the grounds of the Earl's palace, and Rooks were observed at Westness on one occasion.

Fam. *Hirundinidæ*.

Swallow *(Hirundo rustica)*. One misty day in summer four Swallows were seen flying about near

Westness House, and on another occasion about the same time one near the garden wall by the sea. Mr. Learmonth, the farmer at Westness, told me a few once bred here—a very unusual thing, apparently, as it was recorded in one of the Orkney papers.

Sand Martin *(Cotyle riparia).* On one or two occasions when fishing Loch Wasbister I saw a bird of this species flying about the loch. My attendant had no idea what it was.

Picariæ.

Fam. *Cuculidæ.*

Cuckoo *(Cuculus canorus).* This bird, so common in most parts of the Highlands, was only heard here on one or two occasions. Perhaps the cold spring prevented it uttering its well-known note, as May was very cold and disagreeable.

Fam. *Picidæ.*

Wryneck *(Yunx torquilla).* On the 8th of September I shot a male Wryneck as it was flying and settling before me on a stone wall; its flight being unknown to me first attracted my attention. The only other occurrence of this bird in Orkney is mentioned in Messrs. Baikie and Heddle's *Natural History of Orkney* as follows: "A specimen of this bird, caught after a gale, was, we believe, in the possession of the Rev. Charles Clouston, Sandwick."

Columbæ.

Fam. *Columbidæ.*

Wood Pigeon *(Columba palumbus).* A Wood Pigeon stayed about Westness House for a few days at the end of May and beginning of June. At first there was a pair of them, but one either left or was killed, and the other disappeared shortly after.

Rock Dove *(Columba livia).* Not particularly numerous, though a few breed in most of the sea-cliffs round the island. They were most numerous about the middle of August, and after that seemed to leave the island, except one or two favourite

localities, till the end of November, when a few began to show themselves elsewhere again. They feed about twice or thrice a day, and the rest of the time sit quietly in the rocks. One breeding and roosting place I visited was on one of the Green Holms in the Westray Firth, and into this we had to enter on our hands and knees. There were two eggs lying in a nest on the ground, quite rotten.

Pigeons have a regular route to and from their roosting places, but these latter they shift in stormy weather when the spray dashes into them. White varieties and those with the blue rump are common, also those with mottled black markings on the wings. In the Island of Egilshay, where there are no rocks sufficiently high, the Rock Doves breed in the tower of the old church of St. Magnus.

Gallinæ.

Fam. *Tetraoninæ.*

Red Grouse *(Tetrao scoticus).* Whatever may have been the case, the Red Grouse is now an inhabitant of three islands only—the Mainland, Rousay, and Eday. The Rousay birds are said to be the heaviest of any part of Scotland, and when they are at the best—from the middle of October to the middle of November—$1\frac{3}{4}$ lbs. is not at all an unusual weight. After the middle of November I always fancy that grouse get smaller and lighter; they certainly do not appear so large when brought to the table.

In plumage the Rousay grouse vary but little. Here, as in Sutherland, the red variety is the rarest, and I have got cocks and hens almost identical in coloration. They are remarkably silent birds, a crow being rarely heard, even in the breeding season, except early in the morning.

About the middle of October the hens and cocks to a great extent separate, the hens going in parties of from five to twelve. They are then much wilder than the cocks, of which rarely more than three are together. In stormy weather grouse come

down a good deal to the stooks and stubbles in early morning and late evening, retiring to the nearest heather during the day. When the covies get very strong in the early part of the season they run much before the dogs, more so than I have observed elsewhere, and are very apt to rise out of shot. In fine weather in November, up to the end of the season, however, they lie almost too well, letting you pass close to them without moving. In the early part of the season grouse here feed almost entirely on the little black crowberry with which much of the island is then covered, and this is very apparent by their droppings, which retain much of the colouring matter of the berries, and are of quite a different appearance from what they usually are.

Fam. *Phasianidæ.*

Partridge *(Perdix cinerea).* General Burroughs introduced a few into Rousay, and they succeeded for a time; but I heard that this year there were only some four or five left, though there appears no reason why they should not do well, as there is plenty of arable land.

Fulicariæ.

Fam. *Rallidæ.*

Corncrake *(Crex pratensis).* Very common; breeding abundantly everywhere through the island, except on the moor, even in the garden at Westness. I have heard their harsh note as late as the end of July, and on the 1st of August I saw a nest of eggs. I have seen their nest, too, on one of the smaller holms of only an acre or two in extent; one such nest was placed in a narrow drain, hidden by the overhanging grass.

Waterhen *(Gallinula chloropus).* Found one bird on 15th September when out after Wild Ducks at Loch Wasbister.

Coot *(Fulica atra).* Two or three pairs bred on Loch Wasbister. Two nests I saw were made in the

usual place and position, *i.e.*, of green rushes and floating at the edge of a bed of weeds; the other was on the edge of a small island, on the ground, and under a large docken leaf. These birds left the loch as soon as the cover got too thin to hide them.

HERODII.

Fam. *Ardeidæ*.

HERON *(Ardea cinerea)*. Very common except in the nesting season. When not fishing they collect into small parties and sit on the grass or rocks close to the sea.

LIMICOLÆ.

Fam. *Charadriidæ*.

RINGED DOTTEREL *(Ægialitis hiaticula)*. Very common and resident. In winter assembling at times into considerable flocks.

GOLDEN PLOVER *(Charadrius pluvialis)*. By no means as common a bird as I expected. A good many pairs bred on the hill (one pair, above the house, had the greater part of their wings white); but in the autumn they mostly left, and the few that came in the winter were wild and very local; in fact, in the whole of my shooting, about 5000 acres, there was only one small spot where I had much chance of seeing any of these birds. Very few plovers bred on the smaller holms: I only saw one nest containing two rotten eggs, and the remains of one of the old birds were not far off.

LAPWING *(Vanellus cristatus)*. Very abundant through the island, the great bulk leaving in October, though a few linger on as long as the weather is open, and I saw one or two either the last days of November or early in December. They breed undisturbed, as their eggs being small are not much sought after. In one nest I found five eggs just on the point of hatching. When first discovered the young squat very close, but on being lifted up and put down again they run fast enough, stopping every now and then, turning sideways, and bowing most politely.

Turnstone *(Strepsilas interpres)*. Common in autumn, winter, and spring, and a few birds in full summer plumage are to be seen during the breeding season. At the east end of Egilshay I saw several in June and July at a point called the "Grand."

Oyster-catcher *(Hæmatopus ostralegus)*. A very abundant species in summer, but scarce in winter, though now and then a stray individual, sometimes a flock, will appear for a day or two. They breed abundantly everywhere in suitable localities along the coast, sometimes even in grassy ledges of the rocks, as I found one nest by accident in such a position, lined as usual with small stones, and containing the usual three eggs. The Oyster-catcher runs from its nest, and while it has eggs is usually silent, but when the young are hatched it is noisy enough. By the time the young have grown up they have assumed the adult winter plumage, the colour of the legs and bill being rather paler. They are capital swimmers, taking readily to the water even when not closely pursued.

Fam. *Scolopacidæ*.

Woodcock *(Scolopax rusticola)*. Only appears in any numbers when there is frost and snow. Probably they are driven in then from other quarters. Should the weather get very severe they all leave.

Common Snipe *(Scolopax gallinago)*. Very abundant, especially in summer and early autumn. They breed in all the marshy ground through the islands, fresh eggs being abundant about the first week of June. Their nests are placed in tufts of grass, deeply cup-shaped and lined with grass, well concealed like a Redshank's. The hen generally gets off it when one is some little distance away, rises into the air with a spring, and then falls again, often calling at the same time. The summer of 1883 being a very dry one, quantities of snipe collected round Loch Wasbister and the adjacent marshes. In one place so thick were they that I believe I could have shot

half-a-dozen with a single shot as they rose. The old and young are much darker in plumage in the summer and autumn than in the winter; at the latter time I have shot very light-coloured snipe. One day on the moors one of my setters caught and killed a young snipe, and the old bird fluttered about and uttered a curious scream quite different from their ordinary note. I have now and then heard the same note when picking up a wounded snipe. In winter the snipe often come down to the shore, I am told, if the weather is frosty. Snipe nod their heads a good deal after the manner of Redshanks, when they are undecided whether to fly or not. One day in summer I was washing some trout so as to put them clean into the creel, when six snipe flew over my head and settled close to me. One stood on a lump of mud about ten yards off, and when I moved it began to nod. On moving my hands and shouting at it, the bird merely walked behind the tuft without flying away.

Jack Snipe *(Scolopax gallinula)*. Fairly common, arriving mostly in October, though I saw one about the middle of September.

Dunlin *(Tringa alpina)*. Apparently only a summer visitant, as I never observed many after the breeding season. They breed through the island of Rousay, but of all the places visited we found them most abundant in the marshes of the island of Egilshay, and those at the point of Weir. At this latter place we obtained many nests, though, unfortunately, they were mostly too much incubated to be of any use, the extreme thinness of the shell preventing the extraction of the half-formed bird without fracture of the egg; and I noticed that the shell was much more fragile near hatching than at any other time, probably a provision of nature to allow such a tender, soft-billed bird making its way out. We found the first nest of their fresh eggs on 7th June, and on the same day saw young ones a day or two old, showing that they are very irregular in

their time of laying. The last nest we got was on the 17th of July. Of all the nests we found, on only one occasion did we see a bird fly off it. When near their young the old birds were very anxious, running and calling close to our feet; at other times they might be seen watching our approach from any little eminence. They have a very pretty trilling note, uttered probably by the cock when the hen is sitting, sometimes uttered on the wing, at other times when on the ground; indeed, in every respect they are most engaging little birds. The nest is a slight hollow, generally in a small tuft of grass, and not very easy to find. Each pair of birds seems to make several nests before deciding on the one in which to lay. It is lined with a little fine grass.

Purple Sandpiper *(Tringa maritima).* The most abundant of all the small waders; remaining until late in the spring and returning early in October. At high water these birds are fond of sitting on a stone, huddled closely together, and when disturbed often merely take a short flight out to sea and return to the same place.

Common Sandpiper *(Totanus hypoleucos).* Fairly common about the "Muckle" and "Little Waters," where they breed. These lochs are well adapted to their habits, being edged with stones and gravel. I caught a young one about half grown.

Redshank *(Totanus calidris).* Resident, but more numerous during the breeding season, almost every small island being abundantly supplied with them. While they have eggs the birds are quiet enough, but when the young are hatched they deafen an intruder with their noisy clamour. They are very regular in their time of laying, and being absent then I never came across a late nest of eggs. They are fond of haunting the grass fields and damp meadows, the young ones in these places lying almost as close as snipe. When flushed they show much more white, and that of a clearer colour, than do

the old birds. In winter they are fond of feeding in the same damp places near the sea as do the snipe. From never being disturbed they are very tame.

Greenshank *(Totanus glottis)*. I heard one of these birds one day in spring, but they do not breed in Rousay.

Curlew *(Numenius arquata)*. Common, though not very numerous as a species. Neither the curlew nor whimbrel breeds in Rousay, though for the former there are places apparently as well suited to their habits as those parts of Sutherland where they are abundant in the breeding season. Amongst a party of curlews that I saw in June was one of a white or cream colour. Except in severe weather curlews keep mostly to the sea-shore; but in the hard weather, which, however, comes but seldom in the Orkneys, the people complain that they probe the turnips with their long bills. This, however, could only be done when the root had been previously broken.

Whimbrel *(Numenius phæopus)*. Only seen on two occasions; one was on 9th August, in company with some curlews, apparently on their way south.

Anseres.

Fam. *Anatidæ*.

Whooper *(Cygnus musicus)*. Of not infrequent occurrence, and when staying on the island nearly always going to Loch Wasbister, which, being shallow and full of weeds, is just the very place for them, as almost anywhere they can reach the bottom with their long necks. One herd, after being repeatedly fired at on the loch and one of their number killed, never left it, and another was killed the next day.

Sheldrake *(Tadorna vulpanser)*. Common during the breeding season, leaving as soon as the young are fit to go. They breed at times on the hill near fresh-water lochs, and I knew of two nests placed

under long heather, a very slight excavation sufficing in each case; the males of the sitting birds were rarely to be seen on the fresh water, generally living on the shore in a small bay not far from Westness House. One nest I found was in a rabbit burrow, and the eggs, eight in number and in different stages of incubation, were scattered about the mouth of the hole—I could not discover by what means. When hatched they take immediately to the sea, accompanied by both parents.

Wild Duck *(Anas boschas)*. Very common and resident, in winter assembling in large flocks on the shores of the smaller holms, where they live unmolested. They seem to live mostly in the salt water, except during the breeding season. When watching small numbers of these birds, I have noticed that the most of them were paired even in winter; perhaps they pair for life. When young, or in the case of the old birds before they have got quite strong on the wing after the moult, no bird keeps closer to a bit of cover of reeds or rushes; a dog alone can then put them out. The mallards moult long before the ducks, the latter being able to fly as long as the young ones require her care.

Teal *(Querquedula crecca)*. A few appear during winter and spring, but are not very common.

Widgeon *(Mareca Penelope)*. Fairly common in winter and spring, keeping mostly to the salt water, and feeding among the sea-ware.

Pochard *(Fuligula ferina)*. Four pochard drakes remained on Loch Wasbister the greater part of June and July, but only one remained until August, and this a wounded bird unable to fly. There were no ducks with the drakes. A few appeared again in the autumn.

Golden-eye *(Clangula Glaucion)*. Common on Loch Wasbister, remaining until late in the spring, when I have seen it on the hill lochs, probably on its way north. Being fond of feeding and diving close to the

edge, these birds are easily shot by running when they are under water, and stopping in good time before they reappear, getting nearer and nearer at each dive until they rise within shot.

Long-tailed Duck *(Harelda glacialis)*. Very common during the winter and spring, sometimes in considerable flocks, at other times scattered through the whole of the sound between Rousay and the mainland. At a certain state of the tide they were always to be found off the point of Akerness, probably because the water was shallow enough there to allow of their reaching the bottom. Although not at all times easily approached by a boat, yet their restlessness in continually flying about often brings them within shot. Sometimes they will allow a boat to sail quite close to them. Their call-note is most musical.

Tufted Duck *(Fuligula cristata)*. On the 16th of June I saw a male Tufted Duck along with two Pochard Drakes on Loch Wasbister, and on 28th August I shot a female. They are common enough in the winter, Loch Wasbister being rarely without a few. They seem to be fonder of fresh water here than any other species of duck.

Eider Duck *(Somateria mollissima)*. The Eider Duck, or, as it is more generally called in the Orkneys, "Dunter," is a very common species, resident throughout the year, and breeds commonly both on Rousay and the adjacent islands. In summer, when the ducks have hatched, the males assume a darker plumage, and while in the moult and unable to fly, assemble in considerable flocks, keeping away from the shore and frequenting the more open parts of the sounds. So long as it is not far from the sea, an Eider Duck is not particular in its choice of a nesting spot—sometimes it is in a cornfield, at other times, I believe, even in a ploughed field; but their favourite place is the smaller islands, where they are not so likely to be disturbed. Here I have seen the old

duck sitting on her nest while we have been standing round not more than a couple of yards away, but at other times they left it when we were some considerable distance off. Five was the largest number of eggs I found in one nest, four being the most usual. Two nests containing only one and two eggs had no down in them, and the eggs were covered up with moss; so it appears as if the down is placed in the nest only when the full number is laid, and is perhaps added to as incubation goes on. During the breeding season the call-note of the male is frequently heard, much less so in the winter. Except during the hatching and moulting time the Eiders seem to keep in pairs; and though probably several pairs may be collected together, it is easy to see by their actions that they are pairs.

A young bird which I believe to be a male, shot on 8th December, is much darker in plumage than the female. The breast is more closely barred, the feathers of the upper part of the back and shoulders are edged with lighter brown, likewise the upper tail-coverts, the back being dark sooty-brown. On the head there is a tinge of white running from the nostrils to a little behind and over the eye, and this seems more conspicuous when the bird is swimming.

Another male shot on 1st December had nearly completed the adult plumage; but the white still retained traces of black here and there, especially the wing-coverts, which were quite mottled, the rest of the plumage being less brilliant. An especially fine male shot the same day had a green instead of a brown tinge on the light stripe that divides the green on the back of the head.

Velvet Scoter *(Oidemia fusca)*. Common during winter and spring, especially between Kirkwall and Gairsay; generally in small parties of three and four up to a dozen.

Black Scoter *(Oidemia nigra)*. A rare winter visitant.

Red-breasted Merganser *(Mergus serrator)*. Common throughout the year, and although I never saw a nest, they must breed in considerable numbers, especially on some of the small outer islands. I have seen large flocks of them early in June; perhaps some of these would be young non-breeding birds. They are extremely wary. The old males had assumed their full plumage by about the third week in November.

Pygopodes.

Fam. *Colymbidæ*.

Great Northern Diver *(Colymbus glacialis)*. I saw the first "Imber" of the season, a bird apparently in full summer plumage, on 15th October. It rose within twenty-five yards of the steamer, and appeared but little alarmed. They are very common birds here, generally three together—two old and one young one. They have the same habit as the Black-throated Diver of lying on their sides in the water and showing their white breasts. Their cry is a loud and cheery laugh, bringing to me pleasant associations of the Canadian lakes, where often this is the only living creature to be seen or heard. There, too, I never observed them to be accompanied by more than one young one.

Black-throated Diver *(Colymbus arcticus)*. There was one pair to be seen pretty constantly in May and early in June on two lochs not far from Westness House. I often saw pairs of these birds late on in July on these same lochs, apparently migrating, as they never stayed long at a time. Constantly in the evenings at the end of July and early in August I used to hear and see these birds, or the red-throated species, flying over the island, taking a S.W. course, almost always in pairs. Do the old birds leave first, allowing the young ones to follow later on?

These Divers all seem to leave their breeding quarters about the same time. In Sutherland, where they are very common, I never remember seeing any

after the end of July, or the first week in August at the latest.

Little Grebe *(Podiceps minutus)*. A pair of little grebes frequented Loch Wasbister, but I saw neither nest nor young ones, although they might quite well have bred without my taking much notice of the fact. The loch is in all respects suited for them.

Laridæ.

Fam. *Sterninæ*.

Arctic Tern *(Sterna macrura)*. A summer visitant only, breeding in numbers on the smaller islands, or on any place suitable to them. I never saw more than two eggs in a nest in the Orkneys, whereas on the east coast of Sutherland three is the usual number. They invariably breed in colonies, at least I have never seen a quite solitary pair anywhere. When just hatched the young make a harsh but feeble cry, and try to leave their nests as soon as possible. They are grey, specked with black, and have the legs and bill pink, the latter tipped with black.

Fam. *Larinæ*.

Black-headed Gull *(Chroicocephalus ridibundus)*. Common at any time except the breeding season, though rarely to be found anywhere except on the ploughed lands or close to the shore. A large flock near Westness, after feeding, used to go into the bay close by, wash and clean themselves, and then rest.

Common Gull *(Larus canus)*. Very abundant; breeding in some rough stunted heather and low, marshy ground near the sea, and also on most of the smaller islands. From their nests being constantly robbed on the aforesaid stunted heather, the young were very backward, and, when grouse-shooting, bothered the dogs, and, indeed, myself, as the former would invariably point them, and young unfledged gulls were scarcely the sort of game one wanted then. On one or two evenings at Westness great

quantities of "ghost moths" were flying about; and a few of these, and perhaps one or two Herring Gulls, were sailing round snapping the moths up as they flew or settled on the long grass.

Great Black-backed Gull *(Larus marinus)*. Common throughout the year in all stages of plumage. Not requiring its eggs, I never looked for its nest; but I am certain it breeds on the islands about Rousay, if not on Rousay itself.

Lesser Black-backed Gull *(Larus fuscus)*. Commoner in the breeding season than at other times. A few pairs bred near one of the hill lochs amongst the heather, despite its annual persecution at that season.

Herring Gull *(Larus argentatus)*. Very common. A few pairs bred in the same place as the *Larus fuscus* last mentioned, and when in fishing one approached their breeding ground, they wearied you with their clamour. Their great haunt on Rousay was on the "Lobist," a detached piece of cliff, and inaccessible without a great deal of trouble. On this small piece of ground, fifty yards long by ten broad, there must have been more than a hundred pairs of birds breeding, no other gull mixing with them. They built, too, but in scantier numbers, on other ledges of rock, and it was amusing to watch the ungainly-looking young birds running along these ledges.

Iceland Gull *(Larus leucopterus)*. The only specimen of this bird I observed was on the 11th of July. I was out with a friend after seals, and on our approach to one of the skerries not far from Kirkwall, this gull remained after all the rest left the rock, by this means attracting our notice.

Glaucous Gull *(Larus glaucus)*. My keeper shot a fine adult specimen on either the 10th or 11th of October. One or two were seen after that, but not many.

KITTIWAKE *(Rissa tridactyla).* On my arrival at Westness I found the rock-birds had already arrived at their breeding station, though at that period (20th April) they had, of course, not begun to lay; indeed, the Kittiwakes were rarely, if ever, then seen on the rocks, generally sitting in flocks on the water just below their breeding haunts. Being absent the greater part of May, I could not say with certainty when the first eggs were laid; but on my first visit to them in June most nests contained two and three eggs, generally the former number. The nests are located in places extremely difficult of access, often under an overhanging rock, and are made of fine sea-weed apparently collected by one of the birds, the other staying at home to see that none of the materials are stolen, and also to do the making of the nest. As soon as the bird brings in the weed it drops it on the ledge, and the other takes it up in its bill, places it where wanted, and then stamps it down tight with the feet. After a little rest, and a few interchanges of an amicable nature, the first bird drops lightly off the ledge for more material. Every now and then a bird will commence its cry of "kitti-ake, kitti-ake," which is taken up by others near it, making a most deafening noise. A stranger lighting near the nest of another bird is instantly driven off, and this again occasions another outbreak of "kitti-ake." A bird in immature plumage (but not of the year) was not allowed to land on the ledges either. This was the only immature bird I saw until the young of the year began to fly.

When first hatched the young are like other young gulls in their mottled brown-and-black plumage.

The young Kittiwake is fed in a manner similar to a pigeon: the old one arrives and sits on the edge of the nest with its neck largely distended with food, remaining there some time as if ruminating. Presently she puts her head down and shakes herself, probably as soon as she feels the food is sufficiently macerated, she then opens her mouth and the young

one puts its bill into hers and takes out the food. This is done until the young one is satisfied. The old bird never feeds the young until she has been some time with it, however importunate the young bird may be, no doubt because she feels the food is not in a fit state for it to digest easily.

Fam. *Stercorariinæ.*

Richardson's Skua *(Lestris crepidatus).* As far as I could learn, no species of Skua bred on Rousay or the adjacent islands, and the two or three that were seen were in the autumn, and apparently of this species.

Fam. *Procellariidæ.*

Stormy Petrel *(Procellaria pelagica).* It requires a good deal of local knowledge to discover the breeding haunts of these little birds, and it was only on incidentally mentioning the bird to a friend of mine in Kirkwall that I found out where to go for its eggs. The Green Holms are situated in the middle of the Westray Firth, and to make a successful effort to visit them in a small boat, such as I had, requires a fine day and suitable tides, as very little wind raises such a sea as makes the islands unapproachable. We first tried the larger of the two islands; but although we looked for a long time nothing rewarded our exertions, and it was quite by chance we went on to the smaller islands. Here we found no suitable cairns of stones; but on trying a small hole, which appeared like a crack in the peat, of which the centre of the island was composed, I felt something soft and warm. On withdrawing my hand I saw for an instant a small bird with a white rump pass a little opening. I put my hand in again and found an egg which I knew to be a Petrel's. I then tried the other part of the hole into which I had seen the bird go, and drew out the first Stormy Petrel I ever handled. We subsequently found two more, getting the birds as well. When placed on the ground they made very feeble attempts at walking,

but soon took wing on gaining any little elevation. In skinning one of them I found the joint of the thigh-bones had very little flexibility in it, and the thigh-bones were difficult to move from their horizontal position, from which it appears as if it would require some effort to move the legs far enough forward to enable the bird to walk, though perfectly adapted for paddling along the surface of the water. The thighs, too, had extremely little muscle on them.

On a second visit to the same islands we were more fortunate. I again tried a place on the larger island where I had been unsuccessful before, and had scarcely got to the cairn where we had landed on our first visit when I heard a peculiar note quite new to me. It came from under the stones, and may be described by the words "ti-tee-tik, ti-tee-tik," repeated time after time. We set to work in real earnest, and after half-an-hour's moving of stones, ran the noise down in the shape of a Petrel, which we caught and let go again. The egg was unfortunately broken. There were more birds under the stones; but as it took so long to get at them we determined again to try the holes on the smaller islands. Here we were again successful, getting seventeen eggs in all, and the birds mostly on each. Some of the holes were too deep for me to reach to the bottom. The grass that grew over the entrance to the holes was little disturbed by the birds; but by putting one's nose down one could soon tell whether the bird was at home or not—as even while the eggs were quite fresh, and consequently the bird could not have been long there, their peculiar odour was very perceptible.

Alcæ.

Fam. *Alcidæ*.

Razorbill *(Alca torda)*. A common summer visitant, though not breeding in anything like the abundance of the Guillemot. A few birds remain through the winter, and the last day I could get out

in a boat before leaving the Orkneys on 8th December, I shot two. The throat was white—the white from the eye to the bill very indistinct—and they wanted the white line on the bill. In Rousay the Razorbill lays its eggs very frequently in cracks or holes of the rocks, and much nearer the top of the cliffs than the Guillemot. The hen sits with her breast on the egg, and the cock is often to be seen standing near her, or at the mouth of the hole where she is. Razorbills' eggs vary little in comparison with the Guillemot, never having those startling shades of green which in the other bird are so common. I have seen the egg-shells lying near a sitting bird, showing that they are not removed immediately on hatching. When on the water, Razorbills show more of their bodies than the Guillemot, and they erect their sharp-pointed tails.

I am sorry that in my notice of the rock-birds I can add nothing to our knowledge of where these birds pass the winter. Odd ones, of course, occur all about the islands; but no fishing boat can go far out into the Atlantic in the winter, and, indeed, there are very few regular fishermen in Rousay from whom I could make the necessary enquiries.

Guillemot *(Uria troile)*. By far the commonest of the rock-birds, being twice as numerous, if not more so, than the Razorbill. The Guillemots never place their eggs in holes like the Razorbills, but always on the open ledges of rocks. Here, I should say, the prevailing colour of their eggs is green. When hatching its egg the Guillemot usually stands over it, keeping it between its legs. At other times it sits forward on it; and I have seen a bird that was trying to cover its egg with its wing, but a great part of the egg was visible. They seem, when sitting, to keep their backs to the sea. When brooding its young one, the old bird crouches forward, drooping its wings and puffing itself out until the body part looks quite round. They seem most careful in keeping the young birds quite to the back, away from

the edge of the rock. I could never see the young ones fed; but the old bird, on arriving with a fish to the ledges, would hold it in its bill for a long time, despite the efforts on the part of others to deprive it of the same. After as long as ten minutes or a quarter of an hour after its arrival, the bird would turn round and shove or fight its way behind the others, turn its back, and then nestle and apparently feed its young one. When carrying a single fish in their mouth both Guillemots and Razorbills place it horizontally in the bill, head in, and the tail hanging out near the tip between the partially closed mandibles, the fish glistening very distinctly in the sun.

When a Guillemot has its egg on a narrow ledge, it is very careful not to leave it in a hurry for fear of knocking it over. I tried firing a gun under one of the most crowded places to see if they would knock over any of their eggs when thus disturbed suddenly, but although quantities of birds flew out, I saw no egg fall.

I ought to mention that I saw one egg in a crack of a rock.

Black Guillemot *(Uria grylle).* Common and resident, keeping pretty much to the same ground all the year round, except when driven in by heavy storms. They breed in crevices of the rock, and under stones, usually laying two eggs; though I have taken a single egg from under a stone, and seen a single young one in the nest, the latter, though well grown, was still covered with black down. Black Guillemots lay their eggs at times a long way in the cairns near the sea-side, as I have seen three and four birds fly out of one of such places and been unable to find a single nest. As regards the change of plumage, I have nothing to add to Dr. Saxby's notes in his *Birds of Shetland*, except as regards the brown that sometimes appears on the white wing-spot. I observed this once only, either in July or August, out of the numbers that came under my observation.

Puffin *(Fratercula arctica)*. Common in the breeding season, placing their eggs far into holes and crevices of the rocks, at the entrances to which, if the ledges afford a foothold, the old birds are to be seen sitting, looking preternaturally solemn, twisting their heads about from side to side as one looks over the top of the rocks at them: they are indeed comical birds to look at. As soon as the young leave the rocks, the Puffins, like the other rock-birds, disappear almost entirely, a few still occurring about the islands. Up to the time of leaving the cliffs the Puffins retain the large bill-sheath, which is said by Bureau to be shed in the autumn.

Steganopodes.

Fam. *Pelicanidæ*.

Gannet *(Sula Bassana)*. Found more or less throughout the year, except in June and mid-winter, along the coast. When a strong gale was blowing outside, the Gannets used to come into the calm waters of the firths until the weather got more settled. Gannets can be distinguished at a long distance off from Gulls, not only by their flight, but by their very white appearance. Nearly all those I saw were adults.

Cormorant (*Phalacrocorax Carbo*). Resident, though not nearly so numerous as the Shag, with which species they do not mix much, nor do they herd together as that bird does.

In Dresser's *Birds of Europe* a Cormorant is figured in winter plumage, with the white thigh-patch. This I have never observed except in the spring and early summer, nor do I think it can be usual for them to retain it the year round.

Shag (*Phalacrocorax cristatus*). Resident and very abundant, breeding in all the cliffs round the coast. Their nests are composed of sea-weed, which they dive for, and they may be seen carrying it to their nests at all hours of the day. They are very tame

when sitting, and it requires a well-directed stone to make them leave their nests. On a hot day the stench from their nests is dreadful. They are very fond of having their nests on the ledges of rocks which form the small "gyos" (little creeks in the cliffs, perhaps not more than a good jump across, but always with deep water beneath into which they can fall with safety when danger threatens). After the young have left the rocks, the Shags collect into great flocks and haunt the sounds about the islands; they still, however, frequent their breeding-shelves, as well as the rocks on the smaller islands. Whilst on the water I have often seen a Scarf raise itself up and float with its wings raised and open, just as it would do when drying itself on a rock. A favourite place for Scarfs to sit and dry themselves was a point of rock near Westness House, and almost invariably a Great Black-backed Gull was sitting with them. They are considered the best bait, after fish, for lobsters.

VII.

NOTES ON SILENE MARITIMA, LINN.

BY THOMAS SCOTT.

[Read 29th January, 1884.]

THE caryophyllaceous order of plants offers to the student of vegetable morphology many interesting points for investigation: thus, for instance, in the genus *Dianthus*, very many species can most readily be crossed; but in *Silene*, the most persevering efforts have failed to produce, between extremely close species, a single hybrid.* In the genus *Lychnis*, the species *L. diurna*, Sibth., has a decidedly unisexual character, the flowers of the one sex being quite different from those of the other; while *Silene inflata* has, according to Axell, three kinds of flowers,—some with stamens only, some with pistil only, and some with both.† Very many interesting dichogamous species are to be met with throughout the order. In the following notes on *Silene maritima*, Linn., the result of some observations made during last summer, attention is drawn to another point of interest,—the variability of the number of styles in that species.

One of the distinguishing characters of the genus *Silene*, known to botanists, is that the flowers have three styles. For a good many years past I have observed that in the flowers of *S. maritima* there was a considerable variation from the number of styles characteristic of the genus; and also that in the various "Floras" I have had the privilege of consulting, no notice is taken of that variation, so far as this species is concerned. In Hooker's *Student's*

* Darwin. *The Origin of Species*, p. 243.

† Sir John Lubbock. *British Wild Flowers in Relation to Insects*, p. 46.

Flora, where reference is made to such a variation as is here indicated, all that is said regarding it is in the generic description, where these words occur: "styles 3, rarely 2-3." It therefore occurred to me that it might be useful to ascertain the average amount of this variation; and, as a step in that direction, during the end of last summer I examined 1000 flowers of *S. maritima*, collected in four separate parcels from four different places. I had intended that the four places, though confined to Clydesdale, should be widely separated; but circumstances prevented my carrying out that intention, and so I had meantime to confine my operations to our own immediate neighbourhood, purposing to make more extended observations as soon as I should have an opportunity of doing so. My reason for taking the flowers from different places was to ascertain whether difference in habitat, soil, or exposure, could have any influence on the amount of variation. The following tables, the result of these observations, show the variation in the number of styles in the 1000 flowers gathered indiscriminately from the different localities indicated.

I.—250 Flowers, examined 27th July, 1883. Collected in Battery Field (West-end), Greenock.

	No. of Flowers.		Percentage.	
Flowers with 2 styles,	1	...	·4	Variation, 54·8 per cent.
,, 3 ,,	113	...	45·2	
,, 4 ,,	110	...	44	
,, 5 ,,	26	...	10·4	

II.—250 Flowers, examined 9th August, 1883. Collected in Battery Field (East-end), Greenock.

	No. of Flowers.		Percentage.	
Flowers with 2 styles,	2	...	·8	Variation, 52·8 per cent.
,, 3 ,,	118	...	47·2	
,, 4 ,,	104	..	41·6	
,, 5 ,,	26	...	10·4	

III.—250 Flowers, examined 10th August, 1883. Collected between Cloch Lighthouse and Lunderston Bay.

	No. of Flowers.		Percentage.	
Flowers with 2 styles,	2	...	·8	Variation, 44·4 per cent.
,, 3 ,,	139	...	55·6	
,, 4 ,,	100	...	40	
,, 5 ,,	9	...	3·6	

IV.—250 Flowers, examined 13th August, 1883. Collected between Ashton and Cloch Lighthouse.

		No. of Flowers.		Percentage	
Flowers with	2 styles,	2	...	·8	Variation, 54·8 per cent.
,,	3 ,,	113	...	45·2	
,,	4 ,,	106	...	42·4	
,,	5 ,,	29	...	11·6	

A variation is thus shown for the 1000 flowers as follows:

Flowers with	2 styles,	7 = ·7	per cent.
,,	4 ,,	420 = 42	,,
,,	5 ,,	90 = 9	,,

The Total variation—51·7 per cent.—shows that fully half the 1000 flowers had fewer or more styles than the number characteristic of the genus.

If further observations tend to establish the amount of variation here indicated, it will, I think, deserve more special reference in any future description of the species than has hitherto been given to it.

An interesting question suggests itself in connection with this divergence: Is this species of *Silene* in process of development to a more perfect condition? It is, I think, generally admitted by botanists that the symmetrical flower is the more perfect one. The flowers of *Silene* are unsymmetrical, as they have a 5-divided calyx, 5 petals, 10 stamens, and 3 styles; and to be symmetrical, and therefore more perfect, there should be 5 or 10 styles. As the variation in the species under consideration shows a decided tendency towards an equalization of the parts of the flower, it may be that we have here a case of progression towards a higher development. Possibly these or similar tables may, by serving as a basis for future comparison, show whether such a progressive development exists; but for the present it must be understood that these *Notes* are the result of observations made over a very limited area, and that a more extended examination may alter the percentage of variation from that here brought out. Meantime, I shall be very glad of any information bearing on this subject.

VIII.

METEOROLOGICAL NOTES FOR 1883, *AND REMARKS ON THE STATE OF VEGETATION IN THE PUBLIC PARKS OF GLASGOW.*

By D. M'LELLAN, Superintendent of Parks.

[Read 20th February, 1884.]

The year 1883 was remarkably mild, and there were no extremes either of heat or of cold. Crops of all kinds were consequently very prolific; trees and shrubs were in splendid foliage; and flowers and fruits were remarkably fine. It was altogether a year above the average in most respects, and one which can be looked back upon with a fair degree of satisfaction. Our climate is becoming so changeable in its character that it is a matter of congratulation with all of us when we have had a season of prosperity, for truly there are few things affect us more than a bad season. Its effects extend much wider and farther than the most of us imagine, and it has a deep influence on our health and happiness not only in the present but also in the year on which we have just entered.

The month of January, 1883, was chiefly remarkable for the large amount of rainfall, no less than 6·18 inches of rain falling during the month. It was not, however, what could be called a dripping month, as there were 13 days, or nearly the half of the month, on which no rain fell at all. The amount of frost registered during the month was only 17°, the mercury being below the freezing point on 10 mornings. The temperature averaged 38·1; and the prevailing winds were from the south

by south-west. We had the Christmas rose in flower at the Queen's Park on the 8th, and the single primrose bloomed on the 21st.

February weather was of much the same character as the previous month, but milder. Rain fell on 20 days, but the showers were not so heavy as in January, and the rainfall amounted to only 2·29 or one-third of what fell the previous month. It will be observed, however, that the number of rainy days was 2 in excess of January. 10° of frost were registered during the month, on 3 mornings; and the average temperature was 40·1 —a high average for the month of February. There was a large number of plants in flower in the various parks during the month, consequent on the mildness of the weather. On the 4th we had in flower snowdrops, hepatica, Daphne Mezereum; on the 13th, Rhododendron praecox, and the crocus; on the 27th, Erica herbacea, winter aconite, marsh marigolds, and the polyanthus. The prevalent winds during the month were from the south-west.

The mild weather which had been experienced during the first two months of the year continued for only 8 days during March. On the 9th it suddenly changed to extreme cold, the nights being very frosty, and there were high winds from the north-east. On the 16th there was a heavy fall of snow, which lay on the ground to a depth of 12 inches. The thermometer fell below the freezing point on no less than 22 days, and 88° of frost were registered in all. Fortunately the rainfall was very small, there being only 1·25 inches during the whole of the month—the smallest total of any month during the whole of the year. On 23 days no rain fell, so that altogether March was a very dry, though cold, month. The average temperature fell back to 37·1, or 3° less than February. Daffodils appeared for the first time in flower on the 28th, and the Scilla Sibirica on the 31st.

April proved a most seasonable month, especially

for cultivation of soil. Owing to the dryness of the previous month, the ground was in capital condition for receiving the seed, and this is always accepted by the farmer and the gardener as a good omen for the coming season. During the month there were only 2° of frost registered in all. A moderate amount of rain fell—1·92 inches on 12 days—so that a good half of the month was dry, favourable weather. The average temperature was high: 45°; and the prevailing winds were from the west by south. On the 3rd of the month the following plants were in bloom at the different parks—hyacinths, tulips, violas, narcissus, rhododendrons, Ribes sanguinea; on the 10th, Pulmonaria officinalis; on the 12th, the Ontario and Balsam poplars, hawthorn, and elder were in leaf.

May was also another favourable month, the weather being much the same as in April, with an increase in the temperature. Vegetation made very rapid progress, and the small amount of frost—5° during the first week—did not do any harm in the way of checking. The winds were from the south-west, so that there were no dry, cutting east winds to blight vegetation. The double flowering cherry and the bird cherry were in flower on the 8th; the oak appeared in leaf on the 15th; and the ash on the 26th. The total rainfall for the month was 2·3 inches, and the dry days numbered 24. The average temperature was 49°. The cuckoo was heard at the Alexandra Park on the 20th—a rare occurrence.

The weather during the succeeding month of June was again seasonable. As was to be expected, there was a very considerable rise in the temperature—the average being 55°. The rainfall was moderate—2·53 inches—and there were 18 days during the month on which no rain fell at all. There was a very heavy hail shower on the 13th, but fortunately it did not do very material damage, although the thermometer receded very rapidly to 35°. The laburnum, lilac, service tree, and hawthorn were in

magnificent blossom during the early part of the month. There had been no severe check on them during the spring months to blight their buds; and consequently, when the warm weather of June came on, their beauty was seen to full advantage.

July proved to be rather a wet month. Rain fell on 16 days, and the total rainfall amounted to 3·48 inches, or nearly an inch more than the previous month. Nevertheless, the temperature still continued to rise, and the average of the month was 58·1. This high temperature, combined with so much moisture in the atmosphere, stimulated the growth of vegetation in a very marked degree, and there was every promise of an abundant harvest. The foliage on trees and shrubs was to be seen during this month to perfection. The spring had been especially favourable for foliage, and the high temperature and moisture of this and the previous months had perfected it in a remarkable degree.

The month of August began most unfavourably, and the first part of it was very wet. The total rainfall was very large—4·21 inches—and rain fell on 13 days during the month. Towards the middle of the month, however, the weather became more settled, and the latter half was especially fine. The crops were well matured, and altogether there was every prospect of an abundant and prosperous harvest. In some quarters, where the rainfall had not been so heavy in the early part of the month, harvesting operations were begun towards the last week, but they were not by any means general. The display of flowers in the various parks and squares was very good, certainly above the average. The average temperature was high: 58°; and the prevalent winds were from the south-west.

September was really a good harvest month, with the exception of the last 10 days, which were wet, when 3·47 inches of rain fell. Farmers, however, had had a clear month of good weather—taking into account the latter half of August—to secure their crops,

and, generally speaking, harvesting operations were completed very successfully. The average temperature was 54°, and there was a good deal of sunshine during the month, which proved very beneficial to the whole country. The prevalent winds for 20 days were from the east-by-north and south, and for the rest of the month from the south.

The month of October was the most variable on the whole, extremes of heat and cold occurring often within 24 hours. The highest day temperature was on the 6th, when the thermometer stood at 62° in the shade, and in the evening of the same day it suddenly fell to 33°. The first autumn frost was experienced on the 23rd, when 2° of frost were registered. The average temperature for the month was 47·1, and the rain, which fell on 13 days, amounted to a total of 3·28 inches. Flowers continued to bloom well in the various parks, as there had not been any frost yet to speak of, but considerable damage was done to them by a very heavy hail shower which fell on the 15th inst. Upon the whole, however, the month of October was not unfavourable, and the weather during it was well suited for securing any crops still in the fields, and for ripening the woods and buds for the following year.

During the month of November the weather was somewhat mild, wet, and rather changeable. There were only 10 dry days during the whole of the month, and the total rainfall amounted to 5·82 inches. The thermometer was at or below the freezing point on 10 mornings, registering in all 33° of frost. The average temperature was 40·1. The Christmas rose was observed in flower at the Alexandra Park on the 3rd inst.—a most unusual circumstance so early in the winter.

December was an exceptionally mild month for the season of the year. Only 24° of frost were registered during the whole of the month, and the thermometer was at, or below, the freezing point

on only 8 mornings. There were 13 days on which no rain fell, and the total rainfall was 4·30 inches. The average temperature was 40°. The Christmas rose was in flower at the Queen's Park on the 15th, and Jasminum nudiflora on the 20th; and during the month intermediate stocks, wallflower, buttercups, daisies, marsh marigolds, and primroses were blossoming in the various parks. The grass continued to grow, and was wonderfully green for the month of December. The prevailing winds were from the south-by-west and north; and on the morning of the 12th there was a dreadful hurricane which did very considerable damage all over the country.

The following summary and comparison with the previous year may be of interest:—

The highest day temperature during the year 1883 was upon 28th July and 16th September, when the thermometer registered 78° in the shade. In 1882, the highest day temperature was 77° on the 18th May.

The lowest night temperature was on the 23rd March and 28th December, when the thermometer fell to 23° or 9° of frost. In December, 1882, the lowest point reached 9° or 23° of frost.

On 42 mornings during the year the thermometer fell below the freezing point, registering a total of 181° of frost, as compared with 193° in 1882 on 38 days. The average temperature was 47° in 1883, as against 46° in 1882.

Rain fell more or less on 165 days, giving a total of 40·86 inches, as compared with 192 days and a rainfall of 41·35 inches during 1882. Thus showing in favour of 1883 by 27 dry days and ½ inch of rain.

From the foregoing statistics it will be observed that the year 1883 has very much resembled its predecessor as regards the total amount of rainfall and of frost. The heavy rain, however, during the year fell at times not unseasonable for the crops generally. There was a considerable increase in the

amount of sunshine, and consequently a much higher temperature, especially during the months of June and July, which, if favourable, are the most beneficial months in the year for plants and flowers. The result was that almost all over the country there were good fair crops, well secured; and as regards our City Parks, the display of flowers was exceptionally good. During the months of August and September this was notably the case, and the show of bloom was much superior to former years. Geraniums, stocks, and violas continued to flower freely until about the middle of October, when they were very much dashed and cut up with a severe hail-storm. Trees and shrubs all made good growth during the spring and summer months, and were well matured again during the autumn months, so that altogether there is every promise of a plentiful supply of both flowers and fruit for 1884. The exceptionally mild weather, however, which prevailed during the months of November and December, and during the early part of January of the present year, may have a tendency to force on vegetation prematurely, and if a severe check should come later on it would seriously injure both flowers and fruit buds. At present there are signs of a cold snap coming on, and it would be better for it to come now than a month hence, as it will not inflict so much damage. 1883 has proved to be altogether a prosperous and prolific year, and we can only hope that 1884 may be no worse than its predecessor.

Subjoined is the Meteorological Record for the last three years, as kept at the Queen's Park, Glasgow.

COPY OF METEOROLOGICAL RECORD KEPT AT QUEEN'S PARK, GLASGOW.

RAIN-GAUGE ABOVE THE SEA LEVEL, 143·95.

MONTH.	1881.				1882.				1883.			
	Rain-fall.	THERMOMETER. Average. Max.	THERMOMETER. Average. Min.	Dry Days.	Rain-fall.	THERMOMETER. Average. Max.	THERMOMETER. Average. Min.	Dry Days.	Rain-fall.	THERMOMETER. Average. Max.	THERMOMETER. Average. Min.	Dry Days.
January, ...	·40	32	22	27	3·65	43	38	18	6·18	43	34	14
February, ...	3·66	40	32	19	3·89	48	39	13	2·29	46	35	10
March, ...	2·44	44	32	13	3·50	48	38	12	1·25	44	31	23
April, ...	1·33	50	34	22	1·99	49	37	21	2·02	53	37	18
May, ...	3·46	62	42	17	2·41	60	40	17	2·03	58	40	24
June, ...	2·26	64	46	14	3·32	65	46	12	2·54	64	46	18
July, ...	3·80	65	51	11	4·03	67	51	8	3·48	68	49	15
August, ...	3·33	63	48	17	1·82	68	50	19	4·21	67	49	18
September, ...	1·91	61	47	17	3·46	61	44	14	3·47	63	46	19
October, ...	2·22	52	39	23	3·36	54	41	15	3·28	55	40	18
November, ...	5·03	50	37	9	5·50	44	33	11	5·82	45	36	10
December, ...	3·46	44	35	16	4·42	38	28	13	4·30	44	36	13
	33·30	52	39	205	41·35	53	40	173	40·87	54	39	200

D. M'LELLAN.

IX.

THE TOP-KNOTS.

BY W. ANDERSON SMITH.

[Read 29th April, 1884.]

THERE is a class of fishes—of considerable interest in themselves, if not commercially—to which the attention of Scottish naturalists might well be more intimately directed. Of the more important commercial fishes we have a considerable knowledge, more especially in connection with the superficial facts of their natural history; but we are often sadly deficient in knowledge of the less important species, whose life history may be of no little consequence scientifically, and which fishes may even be more valuable commercially than we wot of.

There has been a marked deficiency of workers in this department of natural science in Scotland, so much so, indeed, that in our standard works Scotland figures less prominently than any well-worked English county. This cannot be altogether from ignorance of our marine fauna, so much as from such knowledge being kept in inaccessible stores, often the unpublished note-books of workers in other departments; and it is with the object of drawing forth such information, as well as from a desire to add our mite to the general fund, that we forward such few facts as we have been able to observe in connection with the Top-Knots. The principal member of the family, or sub-family, is *Rhombus punctatus*, Gunther, generally known as Muller's Top-Knot; and its well-rounded proportions point to it at once as intimately allied to the Turbot, the typical *Rhombus*. These very elegant flat-fish differ from other members of the *Pleuronectidæ*—as *Flesus* and *Platessa*, the Flounder and Plaice—not only from their shape,

but equally distinctly from the mouth being turned towards the left hand in place of to the right. It is a remarkable fact that these fishes thus looking towards the left are possessed of much larger mouths than the dexter-gazing families; and being thus enabled to dispose of a larger and more important class of creatures as food, they are fatter, richer, and much more delicate eating. Never reaching any great size, they do not seem to have attracted much attention on our coasts, and are perhaps seldom enticed by the ordinary baits employed. Those that have come into our possession have almost invariably been taken with the sein net, so that they were frequenting shallow water. They were also captured off either rocky or gravelly ground, and not from smooth, sandy, or muddy ground, the resort of the Flounder family. The only specimen otherwise obtained was caught among the seaware on the verge of a rocky island in Loch Linnhe, where it had apparently been driven hurriedly by the keel of our advancing boat. On the whole we cannot consider these fish uncommon with us, while they are all markedly similar in marking and colouring, the latter being rich in tone. We have taken them heavy with roe in June and July, at which season they apparently spawn. The roe is abundant, and of large size compared with the size of the fish. The difficulties connected with the identification of the species of Top-Knots have been too great for us, with our limited means of reference. From the general shape of our specimens we would conclude they were *Rhombus punctatus*, Gun., Muller's Top-Knot, the large mouth, and the proportions, clearly pointing to this fish as figured in Couch. The specimens have invariably a filament formed of one or two rays of the dorsal fin being lengthened next the head and separated from the dorsal, and this is supposed to be a characteristic of Block's Top-Knot, *Phrynorhombus unimaculatus*, Gun., *Rhombus punctatus* of Yarrell. But Couch remarks:—"I

entertain no doubt that this supposed mark is only of casual occurrence, and may as well be met with in one species as the other; as it is not uncommon also in the Turbot, Brill, and, as we shall presently see, in the Megrim or Scald-fish." So that this distinction cannot be relied upon according to Couch. On the other hand, while our fish in no degree resembles the drawing in Couch of Block's Top-Knot, *P. unimaculatus*, Gun., yet the ventral and anal fins are distinctly separated one from the other. In this connection Couch remarks:—"There are variations of proportion on the parts of the body which may be observed when these fishes are brought together; but the separation of the ventral fins from the anal in Block's Top-Knot, whereas they are closely joined together in the present species, is a more decisive ground of distinction between them." This would unquestionably make our specimens to be Block's Top-Knot.

Again quoting Couch, "Mr. Thompson of Weymouth has informed me of an example that was ornamented on the lateral line, near the tail, with a black spot, which had an orange-coloured spot in its centre; and it was also marked with several puce-coloured spots along the base of the dorsal and anal fins." Now, this orange-centred black spot is an invariable and brilliant characteristic of our Top-Knots, and might with justice call forth the appellation of *unimaculatus* as applied to it by Gunther. "We cannot perceive sufficient reason for the trivial name given to it by Risso and adopted by Dr. Gunther (*unimaculatus*, or one-spotted), since both these species are often, and, it would appear, equally marked by a defined circular spot at the side, which, however, is sometimes not to be perceived." It is not the side spot so frequently noticeable on these fishes that calls forth the name, but apparently this brilliant spot on the lateral line.

All things considered we are disposed to look upon our species as the variety of Block's Top-Knot

whose distinctive mark is the orange-coloured centred black spot, and ventral fin separated from the anal. But whether this is an invariable distinction, or sufficient to constitute it a distinct species from Muller's Top-Knot, we are not prepared to say. Both Muller's and Block's are remarkable for the underlapping of the ends of the dorsal and anal fins across the root of the tail underneath. We have only once taken any of the Top-Knots elsewhere in the West, and that was off the west coast of the Lewis, where it wanted the brilliant spot and was apparently unmistakably Muller's of Couch.

Dr. Day calls our species, without doubt, *Rhombus punctatus*, of which it may therefore be a small local variety.

We would recommend the class to the attention of our friends during the coming summer at the coast, when we hope to hear that some addition has been made to our knowledge of their habits, appearance, and distribution. We should be glad to have an opportunity of comparing specimens from the Clyde of any of the species with those of our neighbourhood.

All the rays of this fish are split half-way up, and thenceforth are double to the extremity.

X.

SWALLOWS: SOME INSTANCES OF THEIR RETARDED MIGRATION.

BY WILLIAM CRAIBE ANGUS.

[Read 27th November, 1883.]

THAT the migration of swallows is in some measure dependent on the season and the weather, is well known. In exceptionally wet and stormy seasons, swallows have been known to leave as early as the close of August; and in seasons remarkable for their mildness, when in most nests there would be second broods, I have known them pack so that it would be impossible to form even an approximate estimate of their numbers, and roam about in sheltered nooks so late as the third week in September. Macgillivray records an instance of the appearance of the swallow in 1839 so late as the 7th of October. Mr. Harvie-Brown, in his *Second Report on Scottish Ornithology*, published in the Society's *Proceedings* for 1879-80,* records the appearance of the martin in Berwickshire on 3rd October, 1879; and in his *Third Report*, published in the *Proceedings* for 1880-81,† he gives 24th-27th September as the date of the usual departure of the swallow, mentioning that "they stayed very late this year in some places," and giving on the authority of correspondents the following dates of departure, viz.: 30th September and 2nd October, when martins and sand martins were "numerously" seen; one or two were seen on the 5th, and several on the 10th October, the numbers diminishing with the advance of the season; at Alloa, in 1867, says Mr. Harvie-Brown, one was seen by a reliable witness as late as the 13th of November. Isolated instances of the appearance of

* *Proceedings*, iv. 291. † *Proceedings*, v. 51.

migratory birds at unusual dates may be accounted for by their having missed their way—which they frequently do in storms,—or by their being wounded or otherwise weak—as late broods in bad seasons often are,—and unable to migrate with their more robust fellows. The present paper takes no cognisance of what Gilbert White calls "stragglers." Its object is to record some personal observations of swallows in autumn groups, and of the influence that late broods sometimes have in retarding migration.

On the afternoon of 8th September, 1883, I observed an immense flock of swallows in the grounds of Hamilton Palace. The birds, as if after a journey, seemed tired, and for the most part rested on the roof of the mausoleum, which they literally covered—the tails of the outermost birds projecting in a line of great beauty from the outer edge of the circle at the base of the dome. One or two of the birds rose as if to convey a message to their fellows, who listened as sedately as black-coats in congress. The effect was electrical, and the mass-meeting rose in vocal excitement, thick as swarming bees. Each bird—none evidently being in authority and none afraid—had its say, and, as a matter of convenience or etiquette, expressed itself on the wing. The discussion ended, the birds gradually settled down again into the same silent, sable mass, giving the mausoleum the appearance of being draped in black. For about two hours they alternated thus between stolid silence and vocal flight, their flights becoming less frequent, and extending to shorter distances as it became dark, and their later excursions becoming not unlike the motion to and fro of a weaver's shuttle, or of a ball attached to an elastic thread thrown at intervals from the hand. Their single twitterings on the double journey—for all excitement and volubility had died out of their utterances —were not improbably equivalent to taking the

"ayes" and the "noes" as to the propriety of retiring for the night. However that may be, when they had wholly settled they rose in a body, as if by preconcerted arrangement, blackening the air, and almost instantly alighted on some bushes on the south side of the mausoleum. At the moment I thought it strange that the swallows should avoid the larger varieties of stately trees that here adorn the Palace grounds, and where one would naturally expect that they would roost securer from ground enemies than among the tiny twigs that trembled with the weight of a single bird. But no—the swallows were at home in these ground-thickets. Although pre-eminently a bird of the day, and the acrobat of the sky, the swallow, like the coney and the bat, retires to a hole; and this habit of thus concealing itself has made it both miner and mason, earth-worm and steeple-jack.

Not having previously seen swallows so located, I was curious to know what course they would pursue if disturbed; and when it became so dark that from where I was standing I could no longer see the branches moving, I cautiously walked close to one of the bushes and found the birds asleep. I caught several in my hand, and on letting them go they darted into the bush in the most matter-of-fact fashion, while on further rousing the birds by shaking the bush with my walking-stick, without one word of protest they circled back and settled in the bush from which I had somewhat cruelly dislodged them. On the following day, the weather being fine, the swallows hunted the sunny sides of the enclosures, returning to the mausoleum in the afternoon, and at night they again took to the bushes, the grass beneath which had literally become white with their droppings. I give it on the authority of a resident that the swallows came and went, increasing in numbers till the 15th, when they disappeared, as did also the general flights from the West of Scotland.

An instance of delayed migration came under my observation on 27th September. On the abatement of a storm of wind and rain I happened to go to Tillietudlem Castle, and, although I kept watch during the journey, I did not observe a single swallow. They had even deserted the hoary pile itself, which looked sadly monotonous without the hirundines. Nor did a walk down the river, which was heavy in flood, reveal a swallow, until the inn at the village was reached. Here I came upon a bevy of brown-throats careering over the orchard in front of the inn. The orchard is so happily sheltered that except from its being saturated with the drenching rains it bore no other mark of the storm. The upper branches of the trees were bent in circles with the weight of red and yellow fruit. As the sky was lowering the swallows did not soar, but twittered over and through the orchard with an airy celerity peculiarly their own. I do not think I ever saw the colour of swallows—red throats and white rumps—appear so beautiful as in contrast with the reds, yellows, and greens of this fruit-laden orchard. The interest was increased by a group of newly-flighted swallows resting on a fork-shaped tree devoid of branches, in character not unlike the tree in Watt's well-known picture of a dove on her nest in the unconcealed fork of a tree—the dove that on the abating of the waters did not return to the ark. On this tree sat some half-dozen young swallows, while the old birds fed them from the wing. The young birds sometimes silently accepted their food without leaving the forked stump on which they sat; but more frequently the bird whose turn it was to be fed would joyously meet its parent on the wing, and then both birds rising perpendicularly would for a moment, by the meeting of their bills, form a pointed arch. The act of feeding over, the young bird returned to its former place, the adult departing in search of more food. One swallow, the down on which I could see

with a glass—a partial albino, the wings and tail being white,—was peculiarly noticeable, the tail, when extended (which it frequently was while feeding), strongly resembling an ivory fan. The brood, I was informed, had left the nest on the previous day, and the young in two nests close by were all but ready for flight. Three days later both broods left the nest, and on the following morning not a swallow was to be seen.

Some days later, in the quaint village of Falkland, with its royal palace, picturesque houses, high-walled gardens, and fine trees, I observed another instance of a late brood of swallows retarding migration. Although I had no expectation at that late date of seeing swallows, I was on the outlook for them at all likely places on my way thither; and on reading the *Fifeshire Journal* I saw a welcome paragraph on birds, from which I quote: "The swallows took flight on Thursday (27th September), driven south probably by the glooms and drenches of the previous twenty-four hours. The sojourn was less than the average; for, while the arrival was earlier, the departure was also earlier." Ten days afterwards, however, on Sunday, 7th October, I was gladdened by the sight of a group of swallows serenading the spire of the parish church, as if encouraged in their musical efforts by the melodious message of the iron tongue.* The heads of young swallows jerking out and in from their mud house on the spire, in bo-peep fashion, at once explained the motive of the protracted stay of the birds—doubtless rendered possible by the abundance of insect life in and about Falkland, which has a delightful exposure, and is remarkable for the graceful beauty of its trees.

* Of such sounds our familiar birds have no fear. In the goodly steeple of this church, a pair of pied wagtails, known to the village children as the "spire waggies," nestled for many years close to the bell which not only calls the people to worship, but in early mornings rouses labour from its slumbers.

In the beginning of the season there were three nests in the spire, in all of which were second broods, so it had probably been the home of the whole colony, which numbered about twenty birds irrespective of those in the nest. That the colony should defer migrating till this late brood could accompany them—which they did on the 11th of October, fifteen days later than the general flight,—may be set down to the clan-feeling which is so characteristic of gregarious birds. During the rains of the last week of September, two of the nests lost their hold on the steeple and fell to the ground. From one the brood had fled, but the young of the other fell with the nest on the pavement below and were killed. The young of the latest brood made a narrow escape from a similar fate, the nest falling shortly after their flight. The church-officer, from whom I had this information, added: "I could na ha'e been mair sorry tho' the deid swallows had been my ain bairns."

One other instance of a late brood of swallows as affecting migration is not without interest, and, as it made a great impression upon me, I do not scruple to put it on record. On the last day but one of September, 1878, I was attracted by a crowd of boys to a nest of young swallows in the window of a house in a very unromantic street-corner at Crosshill. A body of swallows were on the move, and were evidently intent on luring away the brood from this nest. They soared in the air, sat on the roofs of the houses, and screamed past the nest, which they sometimes literally covered, holding on to it with their claws, and addressed the inmates in endearing terms. One of the young birds ventured forth and stood on the edge of the nest. He was vain to a degree, and kept elevating his wings and picking at his tail as if he had unexpectedly come into the enjoyment of new possessions. He dropped into the crowd, which so increased the chorus of screaming and chittering that without having been

present I could not have credited swallows with the power of producing it. Another and another in like manner—each more or less careful of his toilet—left the nest, the excitement becoming greater and greater as one young bird after another joined the flock. At last only one, evidently a weakling, remained in the nest; and it took some ten minutes of this coaxing—numbers of the birds actually passing into the nest—to induce it to leave. Such was the pressure put upon the bird that its leaving the nest could hardly be called a voluntary act. But however this may be, when it stood on the edge of the nest it looked smaller than the birds that preceded it; and when it took to the wing it was unable to rise, although it made a strong effort to do so. The heavy strokes of its somewhat clumsy-looking wings, being small for the size of its body, were quickly interpreted by the whole mass of the birds, whose screaming now baffled description. It had hardly sunk half-a-storey below the nest when the birds crowded under it, and literally floated it to the house-top, where it remained, being unable to proceed further.* The circling mass of birds, that but a moment before was wild with excitement, became mute as bats, and almost simultaneously passed southwards. In less than five minutes one of the birds returned, having left the ninety-and-nine to seek the lost one; and having fed it from the wing, in the endearing manner of its kind, with a last "good-bye" took itself off.

* Mr. James Steel, a member of the Society, informs me that about six years ago he witnessed a somewhat similar occurrence in Cross-shore Street, Greenock, where he was attracted by a crowd intently watching on the street a jackdaw that had been disabled by a missile. Two others, attracted by the cries of the wounded bird, came to its assistance; it being unable to fly, each took a side, and supporting it from below, they lifted it to the door-lintel of the adjoining building, where they rested, afterwards lifting their charge to the window immediately above the door. Thus, step by step, the two jackdaws set their wounded companion on the top of the Bank building, where further observation from the street was impossible.

But the fortunes of the swallow in autumn are not always so propitious. I have frequently known broods deserted by the parents in cold and stormy weather. Strange to say, however, this more frequently happens with the swift, which makes a shorter sojourn than the swallow, and, as the Laureate observes,

"The swallow and the swift are near akin."

I may here state that I had an opportunity of examining the nest of a swift, in which eggs were hatched in four successive seasons, and in every instance the young perished, the old birds departing before their progeny were ready for flight. An alteration in the building afterwards allowed an examination of the nest—I had almost said "family vault"—to be made. It contained skulls, bones, and feathers; some of the wings and tails of well-grown birds being intact, but quite inoffensive to the smell. Originally the nest had consisted of the feathers of fowls and pheasants, grass, and the sticky or glutinous portions of fir-trees, matted to about the thickness of half-an-inch. The swift is but a poor architect, the nest being a shapeless mass, and in strong contrast to the beautifully-rounded "clay biggin'" of the swallow. This nest was taken possession of by a pair of sparrows whose progeny were more fortunate than those of the swift, and on whom the remains of the dead swifts seemed to have no injurious effect.

During the recent outbreak of cholera in Egypt, it was stated in the newspapers that the swallows, as if aware of its approach, migrated before it had manifested itself; and, curiously enough, I have heard shepherds and gamekeepers say that the swift, which I do not recollect having seen after the 11th of August, it being averse to the gun, was never to be seen after grouse shooting had commenced.

These are, doubtless, mere coincidences. That the swift generally leaves for its winter-quarters before

that red-letter day in the sporting calendar—the twelfth—is patent to every observer; but it is a fact easily established that no bird is more regardless of the gun. On one occasion I witnessed a continual battery, of about an hour-and-a-half's duration, from two guns against a pair of swifts. The swifts were feeding their young in the nest in a crevice of an old castle, which, being closely surrounded by trees, made the killing of the birds difficult to inexperienced marksmen. The birds came and went with the utmost regularity and fearlessness. Sometimes the swifts would round into the nest or depart therefrom so rapidly that the shooters had not time even to take a bungling aim before the birds were out of sight. One, however, was ultimately shot; but the other, undeterred by the loss of its mate, assiduously fed the young ones till they took wing some nine days after. I have it on undoubted authority that the shooting was carried on with more or less regularity for at least three weeks. The young squires had received new breechloading guns, and the swifts were considered the most convenient objects on which to try their skill in the use of the new weapons.

The scare of shooting, then, can have nothing to do with the early or late departure of the swift from Scotland any more than the capricious departure of the swallow from Egypt can be attributed to the presence of the cholera. The late arrival and early departure of this species, as has been suggested by Gilbert White, is probably owing to the comparative absence or abundance of the insects on which it feeds. Its hunting ground is much higher in the air than that of the swallow; and the existence of its prey may be dependent on fluctuating conditions of atmosphere. If this be so, the presence or absence of the swift, and its sometimes leaving its young—capriciously, if not cruelly, as it seems to us—may be dependent on the aerial existence of myriads of creatures that seem to live above man and his earthly belongings.

XI.

THE MISTLETOE.

BY R. TURNER.

[Read, 20th January, 1884.]

So many tons of outlandish mistletoe are brought into Scotland each Yuletide, and so much eagerness is shown to secure specimens, that it struck me as not amiss to string together a few facts about it for your consideration. The popular notions with regard to the plant are somewhat hazy. That it usually grows on oaks, that it was in former ages the main feature of Druidical worship, and that it is from the Druids that we derive its peculiar association with certain Christmas customs, are all popular delusions. No member of this Society needs to be informed that its occurrence on the oak is exceedingly rare. While its collection was, perhaps, a mere triviality in Druidical ceremonial, it is tolerably certain that its presence at Yuletide junketings has no more to do with the Druids than the kissing under it has to do with Christianity.

With regard to geographical distribution, *Viscum album* is not indigenous in Scotland, Ireland, or the Isle of Man; while it is found in England chiefly in some of the Southern and the Western Midland Counties, getting rarer northwards. It occurs locally in all the countries of Europe, except Lapland and Finmark, and also in Northern Asia. In Southern Europe is found the allied parasite, *Loranthus europæus*, classed in the same order, *Loranthaceæ*, which has many other representatives—including several species of the genus *Viscum*—in Asia, America, and Australasia.

The order *Loranthaceæ* is usually included in natural systems among the Apetalæ—that conglomeration of genera into which, as a kind of limbo, are thrust those Dicotyledons which have not made their relationships and connections plain to botanists. Sometimes it is stowed away among the Calycifloræ. In the recent system of classification which Sachs gives in his *Text-book*, and which is largely based on Braun's *Uebersicht des naturlichen Systems* and Hanstein's *Uebersicht des naturlichen Pflanzensystems*, the *Loranthaceæ* are left virtually outside the pale of classification, along with a dozen other groups, as "families of unknown or very doubtful affinity." The order appears to be nearly allied to the *Santalaceæ*, but this fact helps us little, as that is also one of the "families" of which the affinities are as yet unknown.

The plant is dicœcious, and the specimens seen here so profusely at Christmas are invariably berry-bearing. Green flowers appear in early spring in the axils of the leaves. The male ones have four anthers with a peculiar many-celled development, that open by pores, and are adherent to the surface of four calycine sepals. The female ones have sessile stigmas, and the development of the embryo-sac is very peculiar. The appearance of the ovary has led to its being termed a solid ovary or a naked ovule. Sachs, in his *Text-book*, explains this as follows: "In *Loranthaceæ* the development does not even proceed so far as the formation of a distinctly differentiated ovule; the growth of the apex of the floral axis ceases as soon as the carpels begin to be formed; and the cohesion of these is such that it is scarcely possible to speak of a cavity of the ovary; the formation of the embryo-sac in the axial part of the tissue of the inferior ovary is the only indication that this spot corresponds to the ovule: and since more than one embryo-sac is formed, it still remains doubtful whether the mass of tissue must be regarded as the equivalent of

one or of several ovules." In the Appendix to the same work (English Translation, 2nd edition), reference is made to Treub's observations, which have led him to conclude that in *Viscum album* there is no placenta and no ovule, but that the embryo-sacs are developed in the tissue of the carpels. This rudimentary development seems to be connected with parasitic degradation, as parallel instances are found in many plants of a similar nature.

The woody tissue has also a singular structure. It consists, when young, of eight woody bundles surrounding the pith, and outside these the same number of separate small bundles, constituting the inner layer of the bark. The stem was at one time regarded as articulated—that is, that it had no true woody matter in its nodes, and that the vascular connection of the internodal spaces was thus broken up or only maintained by cellular tissue or pith. The woody portions of the internodal spaces seem, however, to be continuous, and the appearance of articulation to be dependent on the non-continuity of the vessels of the bark. Lindley examined many portions of the plant, both young and old, and concluded that "the true woody and vascular structure of *Viscum* is perfectly continuous through the nodes; that there is no transverse and separating layer of cellular tissue or pith in this portion of the plant, but that the connection of the inner layer of the bark is broken up at the nodes." "*Viscum album*," says Lindley, "has not an articulated stem in the proper sense of the word. The vascular structure of *V. album* is by no means so entirely composed of those peculiarly marked and rather elongated cells as is generally drawn and stated. . . . . No doubt a great portion of the woody matter is composed of cells quite different from those met with in the wood of Exogens; but if the young wood or first-formed bundles be examined, plenty of very

long annular ducts—and (to me) spiral ducts with the fibre unrollable, however, as far as I have been able to detect—will be found. I may also remark that the long pleurenchymatous cells surrounding the first-formed vascular bundles are carried along with the latter to the centre of the plant, around the pith of which they may be found, a circumstance somewhat analogous to that stated by Decaisne to take place in *Menispermaceæ*."*

The most striking characteristic of the plant, however, is its parasitism. It occurs in Britain most commonly on the apple, crab, hawthorn, and certain poplars; but it is frequently found on many other trees both indigenous and introduced. It is very unusual on the oak, pear, beech, birch, bird-cherry, wild cherry, blackthorn (or on any of the cultivated cherry or plum trees), hornbeam, elder, holly, dogwood, boxtree, Lombardy poplar, sweet chestnut, or laurel. There are undoubtedly several causes that may affect such relative frequency, as, for instance, the more plentiful diffusion of its seeds on trees frequented by the birds that eat its berries, or the existence of certain peculiarities of bark that prevent it from gaining a hold. The tannin of the oak may perhaps be injurious to the germinating rootlets, and yet not altogether a protection against the parasite. It is difficult to understand why it should be so common on the apple and so rare on the pear—even when they grow together in orchards—except we assume that there is some difference in the structure of the bark or in its chemical composition that hinders the germinating mistletoe from obtaining a settlement.

The young plant insinuates its radicle into the bark of the victim tree, and it always pushes forward towards the centre of the branch till it reaches the cambium layer, when it ceases to penetrate further. This root is thus at right angles to the surface of the wood; but it gives off several

* *Annals of Nat. Hist.* ix. 84.

side-roots which run along the branch in the bark or on the surface of the wood. Such lateral roots when in the bark send down perpendicular suckers like the original root. The wood and bark of the victim tree form deposits round the suckers in the cambium layer, and thus these come to be embedded in the wood. The lateral roots also produce bud-like processes which grow up obliquely through the bark and appear in the air as little shoots which develop leaves as if separate plants. When the roots get fairly fixed in the medullary system they retain their connection with it by their inner parts which continue soft and cellular, while outwardly they get thickened by woody layers which pass uninterruptedly into those of the victim tree, the rings of growth of parasite and host blending together.

The effect of the mistletoe on its host is to induce prematurely the appearance and results of age. It contains chlorophyll in its cells, and to some extent assimilates atmospheric food like other green plants. Hence it does not draw the whole of its nutrition from its host. Still it is constantly draining away the sap, which is the life-blood of trees, and so injures them.

I shall now proceed to consider a few etymological and mythological points relative to the plant and its various names. Plant-names have an especial interest for botanists, and their evolution is almost as wonderful as that of organisms. Then, besides, as this plant fixes itself on a tree of some kind and lives on it, so have the peculiar eccentricities with which it is associated engrafted themselves on the solemn Christian feast. They are survivals from the long-lost Heathen Yule. Though at one time its Christmas associate, the holly, served to adorn a heathen holiday, the Roman Saturnalia in December, it became connected with the Church at a very early period, while the mistletoe has always remained allied with what the Church classes as the World. It is a pagan plant still, and the customs

for which it is now an excuse are outcrops of superstitious notions and observances deep-seated in antiquity, when the North had a Valhalla and Gods of its own.

The botanical name *Viscum* was its Latin name as well. Virgil describes the appearance of the plant in winter woods:

> "Quale solet sylvis brumali tempore viscum
> Fronde virere novâ quod non sua seminat arbos
> Et croceo fœtu teretes circumdare truncos." *

This word *viscum* is allied to the Greek *'Ixos* (of Dioscorides and Galen) and the Æolic form *Biskos*. The words in both languages, besides signifying the mistletoe, mean bird-lime, and convey an idea of stickiness. Several bird-catching terms in Greek are derived from the plant-name, and our English words *viscid*, *viscidity*, and the like, are from the same source. The mistletoe, then, was apparently among the ancient Greeks and Latins nothing more than a means of making bird-lime and catching birds, and they seem to have paid no manner of superstitious attention to it.

What it was among Celtic races we learn from Pliny, who treats of it in his *Natural History*, book xvi., chaps. 93 to 95. He says there are three varieties, and adds that, "in whatever way the seed may have been sown, it will never come to anything unless it has been first swallowed and then voided by birds, the wood pigeon more particularly, and the thrush, such being the nature of the plant that it will not come to anything unless the seed is first ripened in the crop of the bird." Pliny probably derived this notion from Aristotle *(De Gen. Anim.)*; but, of course, I need hardly add that this is not correct. Though the plant may be frequently propagated in such a way, it is readily so by the berries being rubbed against a branch and so fixed, whether by the hand of man or bill of bird. "It never exceeds a single cubit in height, and is always

* *Æneid*, vi. 205.

green and branching. The male plant is fruitful, and the female barren; sometimes, indeed, the male even bears no berry." If this is what Pliny really wrote, he has made a wonderful muddle of the sexes. If we substitute female for male, and *vice versa*, the statements are correct. Perhaps some learned scribe in copying sought to amend the history. In chap. 94, he describes the process of making bird-lime. In chap. 95, he treats of the miscellaneous facts connected with the mistletoe. "Upon this occasion we must not omit to mention the admiration which is lavished upon this plant by the Gauls. The Druids, for that is the name they give to their wise men *(magos)*, hold nothing more sacred than the mistletoe and the tree that bears it, supposing that tree to be the oak *(robur)*. Of itself the oak is selected by them to form whole groves, and they perform none of their religious rites without employing branches of it; so much so, that it is very probable that the priests themselves may have received their name from the Greek name for that tree." *Drus* is the Greek for oak; but that barbarous tribes should call their priests by a name derived from a language unknown to them is absolutely incredible. Yet in this Pliny was perhaps not quite hopelessly astray; as the word Druid, though of Celtic derivation, has as its root the vocable *dru* (tree), which does not only appear in Greek and in the Celtic languages, but in the Teutonic ones as well, and of which our English word *tree* is a form. "In fact, it is the notion with them that everything that grows on it has been sent immediately from heaven, and that the mistletoe on it is a proof that the tree has been selected by God Himself as an object of His especial favour. The mistletoe, however, is but rarely found on the oak, and, when found, is gathered with rites replete with religious awe." We come to an important passage, and I shall now follow Bohn's translation in the first instance. "This is done more particularly on

the sixth day of the moon, the day which is the beginning of their months and years, as also of their ages, which with them are but thirty years. This day they select because the moon, though not yet in the middle of her course, has already considerable power and influence, and they call her by a name which signifies in their language the all-healing." To this passage I shall again refer. "Having made all due preparation for the sacrifice and a banquet beneath the trees, they bring thither two white bulls"—? the wild white cattle of the ancient Gauls,—"the horns of which are bound then for the first time. Clad in a white robe the priest then ascends the tree and cuts the mistletoe with a golden sickle, which is received by others into a white cloak *(sagum)*. They then immolate the victims, offering up their prayers that God may render this gift of His propitious to those to whom He has so granted it. It is the belief with them that the mistletoe taken in drink will impart fecundity to all animals that are barren, and that it is an antidote for all poisons."

You will observe that the translator here clearly indicates the moon on a certain day as known by the name of "all-healing." According to the corrected text of Sillig, the passage runs: "Est autem id (viscum) rarum admodum inventu et repertum magna religione petitur, et ante omnia sexta luna, quæ principia mensium annorumque his facit, et sæculi post tricesimum annum, quia jam virium abunde habeat nec sit sua dimidia, omnia sanantem appellantes suo vocabulo." Pliny has at best an obscure style, and this passage is certainly involved, leaving it somewhat doubtful whether moon or mistletoe is meant as "all-healing." His subject proper is the mistletoe; but the sixth day of the moon cropping up, off he goes at a tangent to explain why the sixth day and not another day, and this done he takes up the thread of his discourse once more—"omnia sanantem appellantes suo vocabulo." The passage I would

render as follows: "The mistletoe, which they term all-healing, is not commonly met with, but when found is gathered with great solemnity, and especially on the sixth day of the moon (which they reckon as the beginning of their months and years, and of a period of thirty years), because it then possesses abundant active influences and has not yet become half."

Such is, I conceive, the true reading of this passage, and I trust to prove from other sources that the mistletoe and not the moon was known as "all-heal" among the Celts; but before bidding farewell to Pliny, I may observe that some authors have contended that *Viscum album* being but rarely found on the oak is not the plant of the Druids, and that *Loranthus europæus* is. This I regard as utterly inconceivable: 1st, because there is no reason to suppose that *Loranthus europæus* had then a range further north than at present, but many reasons in support of an opposite conclusion; 2nd, because Pliny says distinctly, "rarum admodum inventu," which shows that he was aware that a mistletoe-bearing oak did not often gladden the eyes of the natives of Gaul, even in their vast forest lands. To doubt that he meant the mistletoe seems to me an intolerable incredulity.

It may be of some interest to note here that fragments of mistletoe have been found among the remains of the Lake Dwellings in Switzerland. These old habitations were probably the residences of men of Celtic race. We can readily understand that since it was prized among these people so highly, it would be treasured as a precious thing about their prehistoric homes. These fragments may be bits of boughs cut from oak trees by Druids in those vague ages when Europe was a vast forest-land, and before Rome itself had arisen. We cannot estimate how much human faith grew around them, and how much good they wrought through the subtile influence of a firm belief in their mystic power. There they

are mingled with the debris left to us from the residences of a very ancient race, of which we can say little with certainty. That there was some reason for these lake-dwellers keeping mistletoe about their houses we cannot doubt, and that that reason was a belief in its mystic virtues—health-giving, disease-banishing, poison-resisting—is probable.

So far as spontaneous Celtic customs survive, we find little to lead us to suppose that the mistletoe was ever held by these races in much regard. Welsh, Manx, Gael, and Irish care popularly little about it. In Wales it is the Bardic emblem of Winter, as Trefoil, Oak, and Wheat are of the other seasons. The Trefoil, as the emblem of Spring, suggests the probability of the wearing of the Shamrock in Ireland having its origin from paganism rather than from St. Patrick. As the mistletoe is not native in the districts now inhabited by Manx, Gael, or Irish, the non-existence of popular customs there in connection with it cannot be much insisted on. The French, again, are of somewhat mixed descent, though their blood may have a decidedly Celtic strain; and mistletoe customs prevail mainly among them in Normandy and other districts where the infusion of Scandinavian blood is evident. It is among races of such northern origin that the mistletoe holds its place in popular festivity, and to these the remarks of Pliny do not apply. The order of the Druids is now too long extinct for certainty or precision as to the details of its existence or downfall; but the Celtic indifference with regard to a plant so intimately associated with ancient Druidical ascendency and pre-Christian paganism may have arisen from a determined stand made against it by the early missionaries and converts. Connected with the superstitious rites of a heathen priesthood, it would probably be banned by the first Christian preachers, with all the customs as well that clung around it. When the sacred groves were cut down and Druidism died out, the memory of the mistletoe would also fade away, and the connected

superstitions be viewed probably with abhorrence; for when a complete religious revolution takes place the old gods become demons and the priests usually get a bad name. Paganism lingered longer among the Gaels in Scotland, perhaps, than elsewhere, and there at least the religious change would appear to have been of gradual growth rather than by sudden revolution. The Gaelic word *druidh*, though it has lost the sense implying deep reverence which it probably once conveyed, still expresses a certain respect, meaning a wise man rather than a sorcerer. Nay, there are a few proverbs still surviving that refer not unkindly to the old priesthood, as *Ge fagus clach d'on lar, is faisge na sin cobhair Choibhi* ("Though near is stone to ground, nearer is the help of the Arch-Druid"), and *cho teoma ri Coibhi Druidh* ("As skilful as the Arch-Druid"). Further, in Irish literature, skill and learning seem to be the leading conceptions associated with the word *druidh*.

The name All-heal is the one given to the mistletoe in Erse *(uile-iceadh)*, and in Gaelic *(uil-ioc)*. The Welsh word *(holliach)* is the equivalent of these; but in Wales the plant bears several other names, as *uchelfa, uchelwydd, uchelfel*, &c. The Manx word *geul*, Armoric *gouil*, and French *gui*, all signify mistletoe, and are evidently from the same root. In sound they do not differ much from the words of Scandinavian origin applied to the Christmas season, as in the Anglo-Saxon *Geol* or *Geohol*, Icelandic *Jol*, Swedish, Norse, and Danish *Jul*, Scottish and Northern English *Yule*. That this probably indicates a common root-origin I hope to show.

The word Yule was the old Scottish name for the winter festival, which, till the Reformation, was observed as a great popular holiday. In former times the Court of Session had its "Yule Vacance." That it was a time of general festivity appears from the old ballad—

> "Yule's come and Yule's gane,
> An' we ha'e feasted weel;
> Sae Jock maun tae his flail again,
> An' Jenny tae her wheel."

In August, 1575, the General Assembly petitioned the Regent "that all dayes . . . such as Yule-day . . . may be abolished, and a civil penalty appointed against the keepers thereof by Ceremonies, Banquettings, Playing, Feasting, and other like vanities."*

George Buchanan, in his *History* (lib. v.) gravely derives the word *Yule* from Julius, and considers that it was so named in honour of Cæsar. Other surmises have been made, apparently almost equally fantastic, as in deriving it from the Greek *oulos* or *ioulos*—a hymn in honour of Ceres—and from the Latin *Jubilum*. Yet, though *Yule* is not at all likely to have been derived from the Greek, the word *oulos* or *olos*, signifying the *whole*, has almost certainly the same root-origin as the Gothic *giul* or *hiul*, a circle, a wheel—the type of completeness—to which the word Yule has been traced. This origin of the word is, I think, the most probable that has been suggested. The Gothic *giul* or *hiul* is not only closely related to our English *wheel*, but to our *all*, *whole*, and *heal*. The name for the feast of the winter solstice appears to be connected with the idea of a wheel, implied in the completion of the sun's downward course and the commencement of his upward one; and as a circle from another point of view suggests completeness, the *uil* of the Gaelic *uilioc* seems also to be related to the Gothic word as well as to the Greek *oulos*. The resemblance, then, in several languages between the names for the plant and for the season has thus apparently no direct relation to the connection that has arisen between the mistletoe and Christmas, but is accidental so far as that is concerned, and arises from a common derivation from a primitive root, in which both the idea of a circle and of completeness is conveyed.

In Normandy, and some other parts of France, there used to be a popular custom of giving twigs of mistletoe to friends on the last day of the year

* Calderwood's *History of the Kirk of Scotland.*

with the words "*Au gui menez*," or "*Au gui! l'an neuf!*" (pronounced, in the patois of Touraine, *Aguilanneu*). Rabelais refers to a similar custom in the clause "aller a la gui l'an neuf," rendered by Sir Thomas Urquhart "to go a-hansel-getting on the first day of the new year." Now, these are the very parts of France where the Normans gained sway, and though they adopted the language of those they conquered, there is every reason to suppose that they retained their old customs. It is probable that from this custom and French phrase our Scottish word *Hogmanay*, and the observances connected with it, took origin. In that case we possess a Lowland word that has only one letter *(g)* left to signify the mistletoe, somewhat as a rudimentary organ in some living beings, the last survival of many changes.

I shall now refer to the word *mistletoe*. In Ogilvie's *Imperial Dictionary* (1882), as allied words, are given Anglo-Saxon *mistel-ta* or *mistel-tan*, Icelandic *mistel-teinn*, &c. The following remark is added: "The name seems to mean twig of darkness or mist, and to have been given from the fact that the Scandinavian Sun-God, Balder, was said to have been slain by a twig of this plant, his death symbolizing the victory of darkness over light in the northern winters." I think such a derivation as this is very far-fetched.

That the great sun-myth is brought forward too readily to explain details relating to the mistletoe will appear still more conspicuously in the following extract from Dr. Brewer's *Dictionary of Phrase and Fable* (15th Edition, 1883): "Shakespeare calls it 'the *baleful* mistletoe' (*Titus Andronicus*, ii. 3.), in allusion to the Scandinavian story that it was with an arrow made of mistletoe that Balder was slain." Now, in the works of Shakespeare I have failed to find any reference to Balder, or, indeed, to any of the Gods of the North, or any hint that he had even the faintest glimmering notion of a Scandinavian

mythology. The context clearly shows what is implied by the word *baleful* in this connection:

> "The trees, though summer, yet forlorn and lean,
> O'ercome with moss and baleful mistletoe."

Without any obscuring ideas as to Sun-myths, Shakespeare speaks here as an observer of Nature, and instantly connects effect and cause—the miserable trees with plants that prey on them. It requires no great sledge-hammer of myth to crack such a little nut as this.

With reference to the derivation of the word, it is stated in the same work that "the word mistletoe is a corruption of mistel-ta, where *mist* is the German for 'dung,' or, rather, the 'droppings of a bird,' from the notion that the plant was so propagated." Here the sun-myth is dispensed with, and the idea implied in the old adage, *Turdus malum sibi cacat*, fixed on as the basis of the explanation. That *mist* is the German for dung is true, but that the first four letters in the word mistel have a similar signification is not very probable. That the German word *mist* means rather "the droppings of a bird" than "dung" must be information to most Germans.

Several other etymological explanations of a similar unsatisfactory kind have been made as to this word. These I do not propose to discuss, as a simple and natural derivation recommends itself.

I am of opinion that Prior is right in regarding *Mistel* as simply the Anglo-Saxon word meaning "diverse, different," and *ta*, a twig or little branch. The "tawse" of our boyhood may, in some cases, have impressed a sufficient comprehension of the word *ta* in its Scottish form *taw*. The English words *toe* and *ten* are closely allied, the latter being a plural form that came into use as a number. Mistletoe, then, simply means "the different twig," —a very appropriate name for the most characteristic feature of the plant when observed growing, and the one most likely of all to attract the notice

of men living a forest life. Bacon did not overlook this, and says: "It is a plant differing from that on which it grows,"—exactly what I am persuaded the word means. I may add, however, that the words *mist* (fog), and *mist* (dung), as well as the *mist* in mistletoe, are probably alike derived in the first instance from a primitive root-word *migh*, which expresses mingling or intermixture of different substances. The German word *mist* (dung), in its primitive sense, thus signifies nearly the same as the word *compost*, and the idea of dung as voidings does not seem to be originally conveyed in the word. The Gaelic for mixture is *measg*, which is of kindred origin. But though this relation exists between several words and a primitive root-word, it is as far from correct to say that these words are derived from each other as that the word *mistle* or *mistel* is derived from *mist*, whether meaning fog or dung, or from *measg*, mixture.

In Scandinavian mythology the mistletoe was sacred to Freya, the goddess of love. The peculiar customs now associated with it appear to have their origin in this remote connection, while the season of the year when these customs are recognised links it with the death of Balder and the great Sun-myth of the North. Professor Max Muller, in *Chips from a German Workshop*, says: "There is much suffering in nature to those who have eyes for silent grief; and it is this tragedy—the tragedy of Nature—which is the life-spring of all the tragedies of the ancient world. The idea of a young hero, whether he is called Balder, or Sigurd, or Sifrit, or Achilles, or Meleager, or Kephalos, dying in the fulness of youth, a story so frequently told, localized, and individualized, was first suggested by the Sun dying in all his youthful vigour, either at the end of a day, conquered by the powers of darkness, or at the end of the sunny season, stung by the thorn of winter." Balder was beloved of all the world, and everything in heaven and earth had sworn not to

hurt the beautiful one—save the mistletoe, which, growing not on earth, but on trees, had been neglected. Loki, the spirit of evil, knew of this, and so he made a dart of mistletoe, and, on an occasion when the gods were in sport throwing lance and spear at the invulnerable one, he gave it to blind Hoder to hurl. Balder, the bright and beautiful, fell dead, amid the wails of the gods of Valhalla, and in his breast stood fixed the fatal bough of mistletoe. So runs the legend.

XII.

DISAPPEARANCE OF THE CHOUGH (Pyrrhocorax graculus, L.) FROM THE STEWARTRY OF KIRKCUDBRIGHT.

BY ROBERT SERVICE.

[Read 28th April, 1885.]

THE Chough has completely disappeared from this county, and there are a good many birds left that we could have better spared! Till nearly twenty years ago it was tolerably common on all the precipitous shore cliffs suited to its habits, but it then began to diminish rapidly in numbers, and shortly disappeared altogether. So lately as 1869, Messrs. Robert Gray and Thomas Anderson had information which enabled them to record in their *Birds of Ayrshire and Wigtownshire* (p. 25) that "along the shores of the southern part of Kirkcudbrightshire the Chough occurs in small flocks." In 1873, when he published his interesting little *Handbook of Colvend*, Mr. M'Diarmid could not include the Chough in a list of the birds of the parish which he gives us, for he states (p. 42) that "formerly the cliffs were frequented by the red-legged crow, and they are supposed to have been driven away by the jackdaws, though it is matter of doubt if they have been entirely extirpated." Since 1870, I am aware of a single occurrence only, and that was a solitary bird that frequented the Rerrick Heughs from February to April of 1883, as I was informed by several competent observers who often saw it during the time stated.

The whole line of the Stewartry coast is suitable for a cliff-loving bird like the Chough, and to many portions of the shore no objection can be taken from the bird's point of view on the score of their

non-accessibility, for there are some parts that would test the skill of the climbers of Flamborough Head, or even of St Kilda itself. The precipitous parts of our coast are locally termed "Heughs," and the "Heughs" of Colvend, Rerrick, Muncraig, and Ravenshall, respectively, were the principal localities, almost equal in extent, where the Choughs formerly made their home. In the order named, which is also their geographical position from east to west, we have the relative abundance in which the Choughs frequented them, for it appears that the first-named locality, although it does not seem to offer any peculiar features that would account for the preference, always supported the largest number of Choughs. Mr. Dickson, who was for thirty-four years tenant of Upper Glenstocking, a farm which is fronted by a range of great cliffs, told me that about 1835, and for many years afterwards, the Choughs were not much inferior in point of numbers to what the Jackdaws were at that time, and he says the Jackdaws are perhaps a third more numerous at the present time. Other gentlemen as well qualified to speak on the subject have also assured me of the abundance of Choughs in Colvend between forty and fifty years ago. Mr. Dickson stated that he never remembered noticing more than six or seven in company—they mostly kept in pairs, and were considered very mischievous. They pulled up the young kail and cabbage in gardens, pulled the straws out the thatched roofs of ricks and outhouses, and for thievish and mischievous pranks enjoyed almost as bad a reputation as their congeners the Magpies. After 1860, their numbers rapidly diminished.

On the high rocks near to Douglas Hall the last pair built a nest and laid their eggs in May, 1865. The nest was taken early in that month by my friend Mr. George Black, then a young lad, and who is now a tobacco-planter in Sumatra. In descending the cliff with his prize, Mr. Black had a serious fall;

but happily he escaped with trifling injuries, although all the eggs, with one exception, were smashed. The egg saved was subsequently given to me, and formed a portion of my collection till a few months since. This nest was, I believe, the last one made in the county, for the pair of birds that owned it were shot before they built another.

From the information I have gathered, it appears the Choughs were much less frequent at the Heughs of Rerrick, Muncraig, and Ravenshall than on the Colvend part of the shore-line. One or two pairs bred in or about the famous caves of Barlocco. The proprietor, Mr. M'Cartney, tells me he never succeeded in taking young birds when a lad, although he had often attempted it—the nests being generally in the most inaccessible spots. This must have been considerably over half-a-century since. The birds lingered here until the winter of 1869-70. Mr. Gibson, Inspector of Poor, Auchencairn, tells me that one day during that winter season he was shooting alongshore. Going into the White Cave* a flock of perhaps a score of birds, which he at the moment took to be Jackdaws, flew out past him. Just as they were going out through the entrance Mr. Gibson turned and fired at them, bringing one bird down, which, to his great surprise, proved to be a Chough. Whether any or all of the others were also Choughs is, of course, matter for conjecture only—

"What's hit is history;
What's missed is mystery"!

but the bird that was secured was the last taken or seen thereabouts. At Muncraig Heughs there were several nesting sites in former times, one at least being occupied up till 1863, when the birds were shot. My information from the Ravenshall district is mostly of the negative sort. Mr. Whitney, lately game tenant of Knockbrex and Muncraig, writes that in about fifteen years' (say from 1868) experience

* Dimensions: Length, 252 feet; greatest width, 190 feet; height, 60 feet.

of the coast and its birds "from Ravenshall to the Isle of Hestan," he had never seen a Chough on any part of it. Mr. John M'Kie of Anchorlee, lately Honorary Curator of the Kirkcudbright Museum, to whom I am deeply indebted for making many enquiries on this subject on my behalf, says that Choughs were common on all suitable parts of the coast near Kirkcudbright prior to about 1850, but between that date and 1870 they had all been exterminated.

As an inhabitant of inland localities in this country the Chough seems scarcely ever to have been known. I have not been able to authenticate two or three instances known to me, except in the case of a pair which took up their abode on an old ruined building at Bogrie in 1848. These were seen by Mr. Hastings, taxidermist, Dumfries, and others, and although the birds were evidently preparing for nesting, they disappeared after frequenting the place for several months. There was a strong suspicion that the gun terminated their career.

And this brings me to the consideration of the causes which have been at work in the extinction of the Chough in this country. It is, of course, well known that the species is a rapidly-diminishing one everywhere throughout the British Islands, and owing to what I believe is the invariable coincidence, that as the Chough disappears so does the Jackdaw increase and multiply in the dwellings of its red-legged relative: the consequence is that the latter is blamed for driving out the former. This coincidence has been observed in this country in the same way as elsewhere, but I believe there is no actual proof that the Jackdaw is guilty. Still, the opinion that he is suspected is advanced with more or less confidence by several ornithologists of eminence. But Professor Newton, in the new edition of Yarrell's *British Birds*, seems disinclined to connect the Jackdaw with the disappearance of the Chough, and Mr. Seebohm, in his splendid *History of British Birds*,

now in course of publication, leaves the matter for further investigation.*

The Jackdaw may or may not be to blame; but so far as this county is concerned, I believe he can be easily acquitted. My correspondents, and more especially those who are old enough to remember when the Choughs were plentiful, agree in testifying that the gun first thinned their numbers. Mr. Dickson was especially emphatic on this point as the real cause of the disappearance of the Colvend Choughs. To shoot a Chough from the cliffs was reckoned a "decent sort of feat" in his earlier days, and gamekeepers and others were continually trying their hand at it. I have positive proof that it was the gun that swept off the few pairs that survived up to a comparatively recent period. I am aware that Mr. J. J. Armistead, the well-known pisciculturist, who resides near one of their former haunts, has expressed the opinion *(Zoologist*, 1881, p. 494) that "the Choughs were certainly never driven away by man;" but in face of information exactly to the contrary I have received from old residenters in the same locality, I cannot help thinking that Mr. Armistead's conclusion has been formed on insufficient grounds.

There seems to be no likelihood that our fine sea-cliffs will ever be re-populated with this handsome and lively bird. The Chough is rarely, if ever, migratory, and the nearest places where it is still found—the coast of the adjoining county of Wigtown, and the coast of Cumberland right opposite us across the Solway—will soon be as destitute of the species as we are now. The latest authority on the Avifauna of Cumberland *(Birds of Cumberland*, by "Glaramara," in *Carlisle Journal)* says the Chough may be only "occasionally seen" along the coast.

* By the way, Mr. Seebohm, who is ruthlessly wrathful over the minor and major mistakes made by his fellow-ornithologists, coolly states in the work just mentioned, under his history of the Chough (vol. i., p. 577), that "in Kirkcudbrightshire a few pairs are still known to breed." This has certainly not been the case for 15 years, at the very least.

The Wigtownshire Choughs are, like their compatriots elsewhere, a rapidly-diminishing number, and beyond question in their case this is the work of the gun. At the present rate of destruction amongst the few left, they cannot last above a year or two longer.

It seems rather singular that so few local examples of this bird should exist in a preserved state. I know of one only—an old specimen in the Observatory Museum in this town—which I believe was obtained in Colvend about 1850 by a poacher, whose various adventures and law-breaking exploits are still a frequent theme of conversation amongst the country folks. There are probably other examples of the bird locally obtained in existence, but they are certainly of great rarity. The fine pair in the Kirkcudbright Museum were obtained in Islay.

I will be very pleased should this paper elicit the opinions of ornithologists in the West of Scotland, which is now the headquarters of the Chough in our islands, on the question of the known or probable influences that threaten their total extinction at no distant date.

XIII.

METEOROLOGICAL NOTES FOR 1884, *AND REMARKS ON THE STATE OF VEGETATION IN THE PUBLIC PARKS OF GLASGOW.*

By D. M'LELLAN, Superintendent of Parks.

[Read 31st March, 1885.]

When, twelve months ago, a few notes on the weather of the year 1883 were presented, there was matter for congratulation in the fact that the year 1883 was above the average in most respects, and this year again the retrospect is in every way an exceedingly pleasant one. The farmer is able to look back upon a rich and abundant harvest, and the gardener can recall with satisfaction a fine summer and a seasonable autumn. As regards the total rainfall and the average temperature, 1883 and 1884 are nearly equal; but last year was noted for four of the most violent storms which have swept the country for many years past.

January weather was very changeable, but comparatively mild for what is often one of the most severe winter months. On the 26th and 27th the barometer fell to 28·20, resulting in a great storm of wind from the south-west, accompanied with heavy showers of sleet and snow. The thermometer fell below the freezing-point on seven mornings, and only 12° of frost were registered in all during the month. The total rainfall was 5·55 inches. The plants in flower were the winter aconite, the Daphne Mezereum, the single primrose, and the snowdrop. The average temperature was 40·1.

During February there was a continuation of the same moist and variable but mild weather as was experienced during January. On the morning of

the 20th there was another wild storm of wind from the south-east, which did an immense amount of damage to property all over the country. The thermometer was at, or below, the freezing-point on eight mornings, registering in all 23° of frost. The temperature averaged 39°. The total rainfall was 5·04 inches. The crocus and the Rhododendron nobleanum were in flower on the 11th of the month.

March was remarkable for a very high rise of temperature about the middle of the month all over the kingdom. On the 16th the thermometer at the Queen's Park registered 65° in the shade. On the 19th and 20th a violent storm of wind took place, equal in intensity to the two preceding ones. Only 11° of frost were registered on three mornings. The average temperature was 41·5 as compared with 37° in the previous year. Rain fell on 15 days, and the total rainfall was 2·29 inches. The plants in flower during the month were the daffodil, the periwinkle, hyacinth, and flowering currant. The balsam poplar was in leaf on the 14th of the month.

April was the driest month of the year, and was, therefore, exceedingly favourable for preparing the ground and sowing the seed. It is of the utmost importance to the agriculturist to give the crops a good start, and this month was eminently suitable. There were 20 days on which no rain fell, and the total rainfall was only ·72 of an inch. There were 5° of frost registered during the month. On the 3rd there was a very severe thunderstorm,—a somewhat unusual occurrence in early spring. Vegetation progressed very fast during the month,—the horse-chestnut and plane-tree coming into leaf, and the forget-me-not, Rhododendron, and grape hyacinth coming into flower. The average temperature was 45°.

During May the weather was cold and ungenial for the season of the year, especially during the early part of the month, with showers of sleet and snow. Towards the end of the month it improved

considerably. During the month the following plants and trees were in flower:—Caltha palustris, Trollius europæus, bird-cherry, double-flowering cherry, and lilacs. The oak was in leaf on the 10th, and the ash on the 18th. The cuckoo was heard at the Queen's Park on the 19th—a somewhat rare occurrence in the immediate vicinity of Glasgow. There were 17 dry days during the month, and the total rainfall was 2·92 inches. The average temperature was 50°.

June proved to be a fairly good dry summer month with a high temperature, which averaged 56·1. The total rainfall was only ·77 of an inch. The temperature was very high during the last week of the month, and on the 28th the thermometer registered 87° in the shade—the highest reading during the whole year. The prevalent winds were from the west by south-west. During the month the laburnum and hawthorn flowered very profusely.

July was a wet month, no less than 5·38 inches of rain falling on 21 days. The temperature, however, was exceptionally high, averaging 59·1, and, consequently, this, accompanied with the great moisture, made all kinds of vegetation make rapid progress. Trees and shrubs were in great profusion of foliage, and crops of all kinds looked remarkably well, and promised an abundant harvest.

The month of August proved to be the best and most seasonable month of the whole year, both for the farmer and the gardener. There were 20 days during the month upon which no rain fell, and the total rainfall was 2·71 inches, more than one-half of which fell on the 12th during a very severe thunderstorm, which did considerable damage to flowers and standing crops owing to the heavy hail accompanying it. Nevertheless, harvest was in full operation in many parts of the country by the end of the month. The average temperature was 60°,—the highest of any month of the year. The prevalent winds were west by south-west.

The fine weather of August continued during September, the average temperature being lower, but the days bright and sunny. The total rainfall was 2·29 inches, and there were 15 dry days. The average temperature was 56°. The display of flowers in the various public parks during this month was particularly good, especially in George Square, which looked extremely well, taking into account the overturning it received at the laying of the foundation-stone of the Municipal Buildings in the previous autumn. The prevalent winds were from the south by south-west.

October was also a fair good month, with 19 dry days and a total rainfall of 2·95 inches. The average temperature was 47·1, and the prevailing winds were from the north by north-west. The thermometer fell below the freezing-point on three mornings in the beginning of the month. The rich autumn tints of the foliage appeared to great perfection during this month, as the two previous months had thoroughly ripened and matured all vegetation. On the 25th and 26th there was a severe gale of wind, which did very considerable damage to the country generally and to shipping.

The weather during November was upon the whole quiet and dry. Rain fell for the first ten days of the month, registering 3·8 inches, but the rest of the month was fine and dry with bright sunshine. There were none of those fogs which are so often a characteristic of this month. 62° of frost were registered during 13 mornings, and the average temperature was 39·1. The prevailing winds were south-west.

December was the wettest month of the whole year, rain falling on 17 days, and registering a total rainfall of 6·12 inches. Towards the end of the month frost set in, and the thermometer was at or below the freezing-point on 15 mornings, 78° of frost being registered. The average temperature was 36°. The Christmas rose was in flower at the

Alexandra Park on the 1st, and the Jasminum nudiflorum at the Queen's Park on the 20th. The prevailing winds were from the west by south.

The following summary and comparison with the previous year may be of interest:—

The highest day temperature during the year 1884 was on the 28th June and 8th August, when the thermometer registered 87° and 85° respectively, in the shade. During 1883 the highest day temperature was on 28th July and 16th September, when the thermometer stood at 78° in the shade.

The lowest night temperature in 1884 was upon the 23rd of December, when the thermometer fell to 19°, or 13° of frost. In 1883 the lowest reading was upon the 23rd of March and 28th of December, when the thermometer touched 23°, or 9° of frost.

On 58 mornings during 1884 the thermometer had been at or below the freezing-point, registering a total of 195° of frost, as compared with 181° on 42 mornings in 1883. The average temperature for 1884 was 47°, the same as in 1883.

Rain fell more or less on 192 days in 1884, giving a total rainfall of 40·54 inches, as compared with 200 days during 1883, and a total rainfall of 40·87 inches.

It will be observed from the foregoing statistics and comparison that the year 1884, so far as temperature and rainfall are concerned, was almost a counterpart of 1883. It was, however, much superior to that season in many respects. Sunshine and showers were sent at the most seasonable times for the growth and maturity of the crops, and the result was the best harvest that has been in our country for many years. Trees and shrubs were in splendid foliage and flower, and owing to the fine autumn they promise well for the coming season of 1885.

One cannot fail to notice, on comparing the statistics of these two years, that too much prominence should not be given to average results in tempera-

ture and rainfall. For we have here two years which were practically similar in these respects, but at the same time the result was somewhat different. 1883 was certainly a prosperous year, but 1884 outstripped its predecessor. This was due mainly to two circumstances. In the first place, we have to thank the season of 1883 for maturing the wood of trees and shrubs, for thoroughly ripening the flower, foliage, and fruit buds, and for giving the farmer a firm and healthy seed and a dry and genial soil. And in the second place, the weather of 1884 was moist and favourable in spring and early summer, dry and warm in early autumn, and in late autumn eminently suitable for the ingathering of the crops. It is a matter of congratulation, in our variable climate, when the seasons of the year thus succeed one another in a sequence favourable to the agriculturist, and it is to this fact, coupled with the fine season of 1883, that we are mainly indebted for the prosperous year of 1884.

There are two remarkable atmospheric extremes during 1884 which are worthy of notice. During March a wave of heat, almost unprecedented at that time of the year, passed over Scotland, when the temperature stood at 65° in the shade, and for several days in the middle of the month vegetation started as if by magic, only to be checked, however, in a few days. Again, there were a series of storms, of cyclones, of high winds, which occurred in the months of January, February, March, and October, causing great damage to life and property, and destroying thousands of magnificent trees all over the country. 1884 may be remembered as a prosperous year for the farmer, but its disastrous results among the mighty monarchs of the forest will be seen and felt for many a year to come.

Subjoined is the Meteorological Record for the last three years, as kept at the Queen's Park, Glasgow.

COPY OF METEOROLOGICAL RECORD KEPT AT QUEEN'S PARK, GLASGOW.

RAIN-GAUGE ABOVE SEA LEVEL, 143·95.

MONTH.	1882.				1883.				1884.			
	Rain-fall.	THERMOMETER. Average. Max.	Min.	Dry Days.	Rain-fall.	THERMOMETER. Average. Max.	Min.	Dry Days.	Rain-fall.	THERMOMETER. Average. Max.	Min.	Dry Days.
January, ...	3·65	43	38	18	6·18	43	34	14	5·55	44	37	12
February, ...	3·89	48	39	13	2·29	46	35	10	5·04	44	35	15
March, ...	3·50	48	38	12	1·25	44	31	23	2·29	47	36	16
April, ...	1·99	49	37	21	2·02	53	37	18	·72	53	37	20
May, ...	2·41	60	40	17	2·03	58	40	24	2·92	59	41	14
June, ...	3·32	65	46	12	2·54	64	46	18	·77	67	46	18
July, ...	4·03	67	51	8	3·48	68	49	15	5·38	68	51	10
August, ...	1·82	68	50	19	4·21	67	49	18	2·71	70	51	20
September, ...	3·46	61	44	14	3·47	63	46	19	2·29	64	47	15
October, ...	3·36	54	41	15	3·28	55	40	18	2·95	54	41	19
November, ...	5·50	44	33	11	5·82	45	36	10	3·80	45	34	19
December, ...	4·42	38	28	13	4·30	44	36	13	6·12	40	31	14
	41·35	53	40	173	40·87	54	39	200	40·54	54	40	192

D. M'LELLAN.

XIV.

JOTTINGS FROM MY NOTE-BOOK.

BY DAVID ROBERTSON, F.L.S., F.G.S.

TALITRUS LOCUSTA, *Linn.*

[Read 31st March, 1885.]

THIS species is abundant all along our sandy shores, near high-water, under decomposing sea-weed, and higher, above the ordinary tide-mark, where they burrow to the depth of three or four inches "till they find sufficient moisture for their wants and comfort." Their burrows are small, round, perpendicular holes, about the size of a goose-quill. In some places the sand is so much riddled that the holes are very conspicuous. If rudely disturbed, the occupants are seen leaping about in all directions, and it takes nimble fingers to get hold of one of them. When the sand is gently rubbed off, layer by layer, with the edge of the hand, till the animals are partially exposed, they lie motionless, seemingly feigning death; but if tossed out, as already stated, they at once bound off, endeavouring to escape, which most of them generally succeed in doing.

The belt of sand they usually occupy at high-water is above the ordinary tide-mark, whereby in continuous wet weather they must be exposed to a considerable amount of fresh water. To test how long they could live in that element, two were put into a cupful of rain-water, where they swam about freely for a time. By three hours they were lying on their backs, but when disturbed they made efforts to swim and to stand on their feet, which they only did for a very short time. When taken out of the

water they could still walk and leap a little. At this stage one was laid on sand damped with sea water, and after a little while it recovered, and burrowed into the sand. The other, after five hours' immersion, ceased to live. From this experiment they appear to be able to bear much drenching under heavy rain, where the water drains quickly through the sand; yet we find that a few hours' close confinement in fresh water is destructive to life.

As this species is "never found voluntarily inhabiting the sea," to test how long they would live in salt water, twelve of them were put into a glass jar with about a pint of sea-water, where they seemed at home for two or three days. Although the experiment could not be carried further satisfactorily without food, it showed that they were sufficiently fitted against any deluge or contingency in that way that was likely to overtake them in their natural habitat. They were allowed to remain in the water that it might be seen whether they would or would not in this strait assume cannibalism. On the sixth day they were beginning to be more languid. On the seventh day a few of them were lying on their backs, but still in life. On the tenth day they were all dead. In no case during their confinement in the water was there any attempt made to attack or devour one another. Not even a vestige of mutilation could be seen on one of them. Another batch were kept on damp sand, without food, till they all died, with the same result as above. Messrs. Bate & Westwood, in their *British Sessile-eyed Crustacea*, vol. i., p. 21, quote Mr. Swain, who says "that one day at a picnic party he saw not millions but cart-loads of this species lying piled together along the margin of the sea. They hopped and leaped about, devouring each other as if for perfect wantonness. A handkerchief, which a lady let fall amongst them, was soon reduced to a piece of open-work by the minute jaws of these small creatures." To say nothing as to how the cart-loads of these creatures could live when

thus piled together, these statements agree ill with the result of the above experiments, where numbers of the animals were kept together under different conditions, famishing of hunger, yet not one of them touched another.

With regard to the statement about the destruction of the lady's handkerchief, I enclosed eighteen of the same species of amphipods in a thin muslin bag on taking them from their burrows. Next morning, after thirteen hours' confinement, they were found all dead; but no mutilation could be detected on one of them, nor had any escaped, nor were there any marks of attempts having been made to perforate the thin muslin or get through it.

It might have been expected that when they could make such rapid havoc with the handkerchief, they could soon have made their way through the thin muslin, had they possessed such a propensity.

NOTES ON PEDICELLARIÆ.

[Read 28th April, 1885.]

The use of these organs in the *Echini* has long been a puzzle to the naturalist, and surmises have not been few regarding their true nature and function. Some have supposed them to be parasites; others that they provided for the *Echinus*,—not directly (being situated too far from the mouth of the animal to administer directly to its wants), but by catching passing objects, and holding them till decay had set in, when the odour attracted crowds of other prey that afforded the *Echinus* an opportunity of providing more easily for itself. These and other theories met for a time with more or less favour; but not meeting all the conditions required, one after another was abandoned. There may be a question whether the *Echini* are or are not carnivorous. I have found in their gullets small fragments of red sea-weed pinched into small pieces, but no trace of animal remains could be seen.

Mr. G. J. Romanes, F.R.S., gives a probable explanation of the use of the pedicellariæ. He says: "In climbing perpendicular or inclined surfaces of rock covered with waving sea-weed, it must be of no small advantage to the *Echinus* to be provided on all sides with a multitude of forceps, all mounted on movable stalks, which instantaneously bring their grasping forceps to bear upon and seize a passing frond; the frond being thus arrested, the spines come to the assistance of the pedicellariæ, and both together hold the *Echinus* to the support furnished by the sea-weed. Moreover, the sea-weed is thus held steady till the ambulacral feet have time also to establish their hold on it with their sucking discs."* Lately I had an opportunity of corroborating the same view, having had a few specimens of *Echinus sphæra* in a pail along with other objects. After having taken the *Echini* out, I noticed projecting from the back of a fine specimen of the nudibranch *Doris tuberculata* a number of thin stalks fixed by the one end into the skin of that animal, which stalks, on closer examination, proved to be the pedicellariæ that had been rudely torn away from the *Echinus* when taken from the pail. It was found that both pedicellariæ and suckers were similarly attached to stones and other objects. I had hoped that they would remain permanently attached, so that I could preserve them in that state in spirits; but after a short time both pedicellariæ and suckers let go their hold. Whatever other purpose these pedicellariæ may subserve, I think there can be no doubt that they act in conjunction with, or as auxiliaries to, the suckers of the *Echinus*.

* *Jelly Fish, Star Fish, and Sea Urchins.*—(International Scientific Series), p. 285.

XV.

THE MEDLAR, APPLE, AND QUINCE: REMARKS ON THE STRUCTURE OF THEIR FRUIT.

BY THOMAS KING.

[Read 24th November, 1884.]

THE MEDLAR.—The structure of the Medlar is not only curious in itself, but helps to explain the formation of other fruits of the Apple kind.

I do not intend to examine these fruits in detail, but shall confine myself to this one point—how much of each consists of carpels?

The most remarkable feature about the general appearance of the Medlar is that it seems incomplete at the top end, as if a part had been cut off. This top is, however, not quite flat, but shows at the circumference the five sepals, and within these, reaching to the centre, five rounded swellings arranged in a circle. These are the carpels.

A longitudinal section shows the structure more clearly. The outer, fleshy part of the fruit consists of a hollow receptacle, or, in other words, of the top of the fruit-stalk widened out into a cup. Into this cup the five carpels are inserted; and, as the receptacle does not close over them completely, their ends are left exposed.

That the explanation just given is sound, may be supported in this way. Take a Medlar fit for eating, *i.e.*, in a state of decay. Peel off the skin carefully, after which the receptacular part may next be peeled off, leaving a central mass consisting of the five

united carpels. These last may now be easily separated from one another. If one of them be examined, it will be found to consist of a soft, fleshy outer part, of the same nature as the receptacle, with a hard stone in the centre. If the stone be now broken, it will be found to contain a single seed. I may here remark that if a needle or pin be thrust into the centre of one of these swellings at the top of the fruit, it will go in easily and come out at the other side; but if the pin be inserted in the hollow opposite the sepal, it will at once come against the stone. From this it is evident that the swelling is composed of the contiguous halves of two carpels.

THE APPLE.—If the explanation I have now given of the structure of the Medlar be correct, we need have no difficulty with the Apple, for the corresponding parts are easily recognised in both fruits. On dividing an apple lengthwise through the middle, and examining the cut surfaces, pale-green lines may be seen dividing the surface into a central and two outer portions. If another Apple be cut crosswise, a wavy line will be seen marking out the same divisions. Without attempting to explain the significance of these green lines, which are fibro-vascular bundles, we may say generally that the outer part, *i.e.*, the bulk of the edible part of the Apple, is receptacle, and the part within the green lines carpels. As in the Medlar, there are five of these, united by their sides, each consisting of two parts—an outer fleshy part like the receptacle, and an inner firm part. But while in the Medlar the inner portion is stony, here it is like parchment. Now this parchment-like portion is often described as the carpel, while it is merely the innermost layer or endocarp. To call this carpel is as incorrect as to describe a plum-stone as the fruit of the plum-tree.

THE QUINCE.—Nearly the whole of this fruit consists of receptacle; the fleshy part of the carpels, as seen in the Apple and Medlar, being represented

by a thin spongy layer lying between the receptacle and the parchment-like endocarp.

So far as I have observed, botanists have quite overlooked this layer, and have taught that the carpels consist merely of the thin skin enclosing the seeds.

XVI.

DOMESTIC HABITS OF BUTTERFISH (Blennius Gunnellus, Linn.).

BY W. ANDERSON SMITH.

[Read 28th April, 1885.]

BEFORE entering upon a few particulars respecting this little fish, whose sword-shaped body, with rows of large, dark spots on the sides, is one of the commonest objects of the sea-shore, I will bring together what appears to be known of it at present.

Dr. Day, our latest authority, seems to have advanced not a step beyond Couch in his knowledge of this fish's habits, which seems remarkable, in view of its extremely common character, and wide range in temperate climes. Couch says: "Nilsson says its spawn is shed in November, but it is probable that the season holds through the summer. In the first week in June, Mr. Peach, who then resided at Fowey, discovered the grains of what there seems to be no room for doubting to be the spawn of the Butterfish attached to the under-surface of a stone in the harbour of that port, with the supposed parent near it; and with a microscope a considerable progress was rendered evident in the development of the embryo fish, as promising a speedy birth with resemblance to the supposed parent."

This is all we are anywhere told, apparently, of the time of spawning of the Butterfish, and I cannot help believing that this little is entirely wrong. It would be an equal error for me to declare that the Butterfish never spawns in November, but if it does do so, it is entirely without my experience; and I cannot believe that in Norway or Sweden, where the

sea-water is not warmer than our own, and the climate is much colder, this characteristically shore-fish should spawn so early, anticipating the usual time with us by some months. But if Nilsson is presumably wrong, Peach is decidedly so. By May the time of hatching has passed, and at no time have I ever seen the grains of spawn "attached to the underside of a stone." The habit of the fish is different, and has been so constantly observed by me over a series of years, that no manner of doubt is possible in connection with it.

About the middle or end of February, in a stretch of stony shore, during a very low tide, the domestic habits of the Butterfish may already be observed occasionally, while by the middle of March no one need have any difficulty in obtaining suitable opportunities of watching its simple ways. The fish can endure absence from the water for a considerable period with equanimity, more especially if protected from the wind and cold. In this way, by turning over the larger stones, the Butterfish may be found underneath, left by the retiring spring-tide; and alongside, *but attached to nothing*, will be found a ball of spawn somewhat larger than a walnut. The ova are of an opalescent appearance, remarkably distinct from other shore-fish spawning in the spring; and they are carefully watched *by both father and mother* up to the time they are incubated, with a very moderate supply of umbilical sac to start the world for themselves.

I should say the period of their spawning may be said to extend from the middle of February to the middle of April; March being, properly speaking, the principal month.

This little knot of eggs matures rapidly, the parents remaining by it closely, and apparently sickening and becoming weaker during the period of incubation. It is probable they only obtain as food what the sea brings them at this time, and that anxiety is aided by starvation, and the weakness consequent

upon spawning. At any rate, this usually very lively and active fish is sluggish, weaker in colour, and more lethargic at this time—the intelligent eye looking at its captor with almost a beseeching expression, probably as much for its offspring as for itself. In captivity the two parents lie around the knot of spawn, with their heads and tails reversed, in two concentric curves, paying most devoted attention to them if still incompletely incubated. The knot keeps steadily expanding as the young advance in development, so as to permit of a more complete aëration of each individual egg or eyed ovum, until it reaches a point in which it is difficult to conceive what attraction holds them together, so slight is the point of contact, while they are by no means remarkably glutinous.

Very few of the ova are thus unfecundated or fail of incubation—the ova, indeed, being less numerous than in many fish. This seems to be the case with those fishes that pay especial attention and give affectionate care to their young. Leaving little to chance, they do not require such an excess of productivity. As cases in point, we have not only the *Syngnathidæ*, but the various species of small sucker-fish—all careful parents, not over-productive. The restless, nervous activity of the Butterfish is dependent upon light. If these fish are placed in captivity in an open vessel, they will leap out if they can; but if provided with the smallest shelter, behind or beneath which they can place themselves, they are apparently quite at their ease and remain quiescent. One I recently kept by me for observation, while surrounded by a very numerous progeny that had hatched out on the way home, did not show the same interest in them, now they were free of the slavery of their fellows and the necessities of their production. The mother was constantly leaping from the water, until I placed a mussel shell in beside it, when it was perfectly satisfied with this very inadequate protection, remaining curled around it, and peering up with its very gentle expression.

Although these little fishes are not supposed to be other than shore-frequenters, we are disposed to give them credit for greater courage in exploring the deeper waters than is ordinarily accorded them. Dr. Day, quoting Mr. Dunn, says: "I have a *Butterfish*, Couch, caught near the surface of the sea in a pilchard net, three miles from land, in 35 fathoms of water." I have shot a "dooker," *Uria grylle*, with a Butterfish in its *bill* over ten fathoms, and taken them in the dredge at various depths from seven to twelve. Being a strong fish, well-boned, there is nothing to hinder it going where it pleases; and although it possesses not the swimming powers of many smaller fishes, it yet progresses with great ease and facility in plenty of water, and in a manner scarcely to be expected from its sputtering habits in confined pools. The umbilical sac, where the young are incubated, is smaller in this fish—it appears to me—than in many other species, and although I cannot absolutely say what time is required for incubation and subsequent absorption of the sac, —owing to the difficulties arising from varying temperatures—I am disposed to consider a fortnight sufficient to cover both periods, and to suffice to send the young Butterfish out dependent on its own unaided efforts.*

When we consider the facility for obtaining the species, no one of the domestic fishes gives better promise of easy study. I hope many will capture both parents and their ova, and add to our knowledge of their very interesting habits.

* Since the above was written I have incubated ova, and kept the young for twenty days, at the end of which time the umbilical sac was about absorbed. Allowing for the altered conditions and defective aëration, their growth is evidently slower than I calculated.

XVII.

EXPERIMENTS WITH CHILIAN SEED-POTATOES—Report for 1884.

BY THOMAS KING.

[Read 30th December, 1884.]

THIS is now the third annual report on the Chilian Seed-Potatoes; and in order to connect the three reports, I will very briefly summarise the previous two.

The object I had in view was to find a disease-resisting potato; and I was of opinion that the disease had been induced by a long course of injudicious treatment, which had at length so weakened the constitution of the potato that it was unable to resist the attacks of the fungus, and so fell an easy victim.

Holding these views, I naturally thought that if a sound stock were introduced into this country it would produce healthy offspring; and accordingly, in 1882, I had a good cultivated variety sent to me from Chile, a country that has never been visited by the potato-disease. They arrived in good condition, and were planted in May; but in July I observed that the leaves were spotted with *Peronospora infestans*. The shaws grew strong and tall; but the crop was poor, the tubers being few and small, and some of them diseased.

The sound part of this first crop was kept over till the next spring (1883), and planted early. Speaking generally, this second crop was better than the first. The shaws were not so rank, and the tubers were very numerous, and few diseased.

Their size, however, was small, as if our summer had been too short for their full development.

In the spring of the same year (1883) I received another lot from Chile. These appeared to be a different variety from the first lot, but afterwards turned out to be the same. They were planted at the same time as the others; but they yielded a smaller crop than those that had been a year longer in this country, and were also slightly touched by disease.

I now come to the results for the present year.

Mr. Boyd, our Secretary, reports as follows:

"*Report on Chilian Seed-Potatoes, grown at Seamill, West Kilbride.*—Most of the Chilian potatoes which we dug last autumn were preserved and planted again this spring in our garden, along with the ordinary home varieties; and I am glad to be able to report that in all respects the result attained this season shows a marked improvement over that of last year. There is a much smaller proportion of under-sized tubers,—indeed the yield compares favourably, as regards both size and number, with the common garden sorts. While a little disease may be detected here and there on some of the tubers, the majority of them appear to be quite sound. As regards the quality, we boiled a few of those grown last year, and found them to be very firm, but apparently somewhat immature. Those grown this year, however, have improved very much in quality, as their flavour is more agreeable and their consistence more 'mealy' than the former season's crop. I am sorry that no details of weight, &c., have been kept; but there has been a decided increase in the yield, as we have now sufficient tubers to fill a good-sized hamper. Although the 'shaws' when growing differed somewhat in appearance from those of the common sorts, their size was not nearly so conspicuous this year as last; and the growth of the plants seems to have been more underground than above, resulting in diminished shaws and larger tubers.

This is no doubt due to the potato having become more acclimatised, and therefore better suited to our soil."

Mr. Notman, Innellan, says: "I am sorry that I cannot give a very bright report of the Chilians. There are certainly some larger potatoes among them than last year, but as a whole the crop (in common with all other potatoes of crop 1884) was poor. Those longest in this country are the best. I have observed this from the time we got a second lot to compare with the first. We boiled some that had been cut by the fork; the flavour was good and potato-like, but they were—not wet—but waxy."

These, like Mr. Boyd's, were grown in the garden. The following reports are on lots grown in the field:

Mr. Lindsay, Langdyke, Fenwick, reports: "The Chilians were better this year than formerly, but there is room for improvement yet. They were larger, and more of them at the shaw. They like plenty of room, and grow deep and wide in the drill. We have never had a meal of them, but I boiled a few from curiosity. They are a little soft, but well-tasted. The sort longest here grew larger than the others; but as they appeared to be the same potato, we put them together. Tayburn had some this year; he says they did better with him too, and he has kept on a seed."

Mr. William Lindsay, Craigends, Fenwick, says: "We planted a few Chilians. Their stems and leaves were not so rank and strong as the first year, and the roots were a better size. It was a fair crop and no disease."

From England I have received no detailed report, but have heard in a general way that these potatoes have done well this year.

Mr. Thomas Brown, Ardneil, West Kilbride, writes: "The Chilian potatoes have done very well this season. They were on good land, and have improved in the cultivation. Those grown here in the

year 1883 were fully as prolific as the seed you sent in the spring of the present year. They are quite free from disease; but we have not had so much disease on potatoes generally this season as in some of the past seasons. I may say the long-shaped potatoes did not crop quite so heavily as the others, but were quite an average crop."

I may here explain that Mr. Brown has had the Chilians for only two seasons; and that the seed I sent him this spring, which has not been quite so prolific as the other, was the produce of the second lot imported. The "long-shaped potatoes" mentioned by Mr. Brown are the Papas-Reynas (Queen Potato), a third variety of which I have yet said nothing, but may give their history on some future occasion.

From the details I have now given, it will be seen that the second crop was better than the first, and the third better than the second; also, that the seed imported in 1883 has not yet made up on that imported a year earlier—all which goes to prove that these foreign plants are taking a few years to become acclimatised. They have behaved like some Australian potatoes I spoke of last year. These were given by a sea-captain to my brother in Chile, who planted them in his garden, where they produced immense shaws, but no tubers to speak of. I believe that the produce, such as it was, was not planted the following year.

Mr. Darwin, in his *Animals and Plants under Domestication*, vol. ii., p. 297, gives some curious facts on acclimatisation. He says: "With the varieties of many plants, the adaptation to climate is often very close. Thus it has been proved by repeated trials that few, if any, of the English varieties of wheat are adapted for cultivation in Scotland; but the failure in this case is at first only in the quantity, though ultimately in the quality of the grain produced. The Rev. M. J. Berkeley sowed wheat-seed from India, and got the most meagre ears on land which would certainly have yielded a good crop from

English wheat. In these cases varieties have been carried from a warmer to a cooler climate; in the reverse case, as when wheat was imported from France into the West Indian Islands, it produced either wholly barren spikes or furnished with only two or three miserable seeds, while West Indian seed by its side yielded an enormous harvest. Here is another case of close adaptation to a slightly cooler climate: a kind of wheat, which in England may be used indifferently either as a summer or winter variety, when sown under the warmer climate of Grignan in France, behaved as if it had been a true winter wheat."

From this the question naturally arises: Supposing these experiments with the wheat to have been continued long enough, would the different varieties have at length adapted themselves to their new conditions, or would their characters have proved to be so fixed that they would have been incapable of adaptation?

Again, it may be asked: Will these Chilian potatoes ever adapt themselves to the climate and soil of Britain? This is yet undetermined.

Some of my friends, discouraged at not getting a good crop on the first or second trial, have given up the experiment; but I think it should be continued for a few years longer, to see what result will be ultimately attained.

As regards the problem of how to get rid of the disease, I am happy to see that it seems to be already partially solved, several of the varieties raised from seed out of the "plums" being practically disease-resisting. It is therefore unnecessary to go to a foreign country to find a sound stock.

XVIII.

A CURIOUS DWELLING FOR A HERMIT-CRAB.

BY THOMAS SCOTT.

With one Plate. [I.]

[Read 31st March, 1885.]

On the 7th of February last, my friend Mr. John Murray, Greenock, brought me a rather curious marine object which had been got in Gourock Bay. It had an irregular, rounded form, and was rather firm in texture, its diameter being about $1\frac{1}{4}$ inch, and its colour dusky. In size and colour it very much resembled a small tuber, and has been called by some friends a "sea potato." There was an opening in the side of this "sea potato" of a somewhat regular outline, which formed the entrance to a cavity penetrating deep into its substance (fig. 1). Just visible within the cavity we could see what looked like the claws of a crab, merely the tips being shown. In fact, it was rather puzzling at first sight to make out what the object could be.

As soon as I had a little leisure I bisected the "potato" through the middle of the opening referred to, as nearly as possible in the plane of the curve of the cavity; and the true nature of the object then became apparent. It proved to be a sponge; and on boiling a little of its substance in a dilute solution of caustic potash, an immense number of slightly-bent needle-shaped spicules were obtained, the spicules being all of this form. It thus agreed fairly well with the genus *Hymeniacidon*, described by Mr. Philip Henry Gosse in *A Year by the Shore*. I also found that the cavity referred to took a spiral form, with the turns nearly in the same plane (fig. 2), and

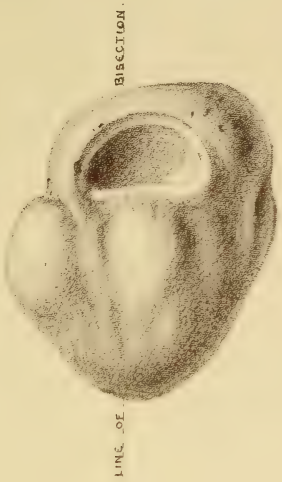


Fig. 1.

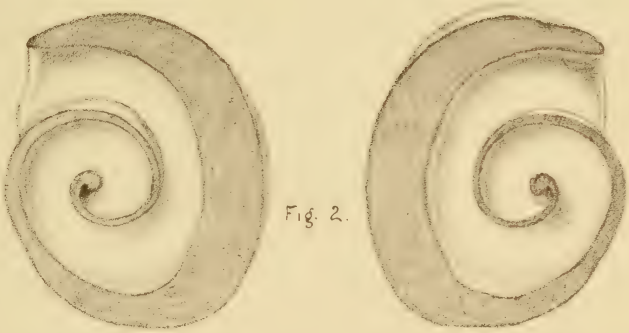


Fig. 2.

J.J.F.X. King delt et lith.

A CURIOUS DWELLING FOR A HERMIT CRAB.

that the claws we noticed belonged to the Hermit-Crab, *Pagurus Thomsoni*, Bell. At the apex of the spire, and buried in the substance of the sponge, was a piece of *Turritella terebra*.

Such are some of the principal features observed outside and inside of this "sea potato;" and we have here, I think, the outline of a rather interesting history. Let me refer to some of its more striking points. True to its instincts, this *Pagurus Thomsoni* had in its early days taken up its abode in the piece of *Turritella*; and about that time a sponge had also fixed upon the same piece of shell as a site on and around which to build its complicated structure. As time passed, the size of the sponge increased till it enveloped the piece of shell, and had the hermit been a stay-at-home sort of fellow, he might have found some morning that his house had become his tomb. But, thanks to the restless, inquisitive disposition characteristic of his family, he was not to be caught napping; and though the sponge tried, no doubt, to surround him,—though he was besieged by a sleepless, untiring foe,—he was not only able to circumvent his enemy, but to construct out of so dangerous an environment a comfortable abode for himself. The sponge increased in size till the fragment of *Turritella* was buried deep within its substance. *Thomsoni* had also been growing, and would, in the ordinary course of nature, have had—not from show, but from necessity—to look out for a larger house. A hermit's "flitting" is, by the way, an interesting process; and I will describe one that came under my notice the other day. Among some marine objects, on which I was making observations at home, was a *Pagurus Bernhardus*. Its house was a small periwinkle, but somehow the house was not satisfactory, and rather than put up with its discomforts *Bernhardus* left it in disgust, to become a homeless wanderer. I had a short time previously thrown an empty *Purpura* into the water, and as *Bernhardus* was roaming about, and very likely be-

moaning his disconsolate condition, he came across this "house to let." He first took a look in, then pushed his large claw in as far as he could reach; but as he did not seem to feel sure that all was right he went along one side of the shell, round the apex, and back along the other side, seeming to examine carefully as he went. Coming to the mouth again, he looked in; and now being satisfied, he turned himself a little way round, at the same time holding up the shell, and, with a dexterous movement, as if born and bred to the work, thrust his tail into his new domicile. Still things were not to his mind; so, steadying himself by his claws, one on each side of the shell, he raised himself up, and then gave a powerful backward thrust which enabled him to get farther into the shell and possibly get a firmer hold with his tail appendages. At any rate he now seemed to be all right, for, after giving himself a tidy up, he set off with his new house. But to return—our *Thomsoni*, instead of having like *Bernhardus* to look out for a new house for itself as it grew bigger, found that in the growing plastic substance of the sponge it could form a dwelling to suit its own requirements, and thus save itself the trouble and annoyance of removing "to other and more commodious premises."

I might dwell longer on this interesting combination of interests—as interesting in a way as that of the *Adamsia* and another *Pagurus*; but I reluctantly pass from the life and adventures of this particular crab to some points bearing on the life-history of the genus.

It will be observed, in the first place, that the house which the crab made for itself in the sponge was spiral. Now, so far as the sponge was concerned, there was no necessity for the structure being spiral; it might have been straight, or of any form of curve whatever, had it suited the crab so to make it. Supposing the spiral univalves, in which we find these crabs, to be used by them not from

choice but from necessity, and that if they should have had the choice of other forms, they would have chosen a form differing more or less from the kind of univalve they now occupy, then we should have found in this case, where no obstruction appeared to be in the way, that the crab would have made its house of a form different from that of a spire. But though the spiral form has been adhered to, a slight difference will be observed. The univalves usually occupied by the hermits have the spire more or less drawn out into a turreted or conical form, whereas in the present instance the turns are practically in the same plane, which, as we shall see, is rather significant, and may help us in our endeavour to answer the two following questions, viz.: 1st—Have the spiral univalves in which we usually find the Hermit-Crabs, no matter what species, become from long-continued habit a necessary form? Or 2nd—Supposing there had been a number of forms to choose from, would the spiral form have been selected because of its being more suitable to the conformation of the creature? You are, of course, aware that the *Paguri* have been in the habit of living in spiral univalves for a long time past—at least as far back as post-tertiary times, when Scotland was an archipelago, with icebergs floating about the narrow channels and grounding in the shallows, leaving their débris to remain an interesting study to the coming ages. We know that this is true, not only because we find the remains of these crabs in the post-tertiary clays, but because we find in the same clays the shells they have actually dwelt in,—shells rubbed and polished on one particular side by having been dragged about by the hermits, just as we find the shells rubbed and polished by being dragged about by the hermits of the present day. It is very likely, then, that this habit was acquired at a very early date—probably much earlier than the time we speak of; and it would be no wonder if a habit so long-continued,

even though acquired not from choice but from necessity, should have become a permanent characteristic. Reasoning in this way, I was therefore inclined to answer the first question in the affirmative—that the spiral dwelling which the crab had formed in the sponge was the result of long-continued habit; but further consideration of the problem led me very much to abandon that idea, and to ascribe the spiral form of the crab's dwelling in the sponge rather to the conformation of the body of the hermit than to habit.

In studying the *Crustacea* it will be observed that among the decapods, to which the hermits belong, the abdomen is either entirely folded underneath, as in the edible crab, or has a tendency to curve more or less downwards, as in the lobster. Now, if the curve of the abdomen were to be continued forwards, the result would be a more or less convoluted spire, and the convolutions would be very much in the same plane. Such is the form of spire we find to have been formed in the sponge (fig. 2). It is therefore likely that the spiral shell is selected, even supposing there had been other forms to choose from, because it is best suited to the conformation of the hermit, and not so much from long-continued habit, or because no other form is available. If I am right in my conjecture, then to my mind there is here another evidence of "design in nature," and that

> "The Lord is good to all:
> His tender mercies are over all His works;"

—providing for all creatures so as to enable them to fulfil the purpose of their being.

XIX.

NOTES ON SOME OF THE PLANTS OF THE CLYDE DISTRICT.

BY D. A. BOYD.

[Read 25th November, 1884.]

SINCE the publication of the *Clydesdale Flora*, many stations have been recorded for our rarer Flowering-plants and Ferns in addition to those mentioned by Mr. Hennedy; and several species, not previously known to occur in the West of Scotland, have been added to the list of plants found in the Clyde district. This result is largely due to the steady increase which has taken place in the number of our local workers, to whom the Society is indebted for the permanent record in the *Proceedings* of not a few facts of interest to the student of Topographical Botany.

The importance of preserving a careful record of new localities, and of the scarcity or abundance of certain species in some parts of the district as compared with others, is too obvious to call for any special remark; but this does not seem to have been fully appreciated in the past, as no systematic attempt has hitherto been made to preserve in a permanent and accessible form the observations made from time to time by individual workers. It is only by means of such records that a correct estimate can be formed of the number of our native plants, and the extent of their distribution.

The following notes consist, for the most part, of observations recently made on some of the plants occurring in parts of the district where I have been working, especially in relation to the distribution of local species, and to stations not already mentioned in the *Clydesdale Flora*, *Notes on the Fauna and*

Flora of the West of Scotland, or the *Proceedings* of the Society. Although such details possess little importance, or even interest, in themselves, I offer them in the hope that they may induce other workers to contribute similar lists dealing with other parts of the district. Were such lists regularly supplied and published in a tabulated form, they would not only afford considerable aid to local students but would throw light on many interesting features in the Botany of the West of Scotland.

Thalictrum flavum, L.—Rare; reported to be fast disappearing from the few spots on the Clyde near Glasgow where it has long been known to grow. In most of these—the borders of fields—it is frequently cut down along with the grass. I am glad, however, to learn that another station has been discovered near Dalmuir, where the plant is in less danger of being extirpated.

Papaver Argemone, L.—Rare in most parts of the districts; but occurring not unfrequently between the Clyde Ironworks and Mount Vernon village, on waste ground, railway embankments, &c.

Erysimum orientale, Br.—Alien; I observed a few plants last year on the railway between Dalmuir and Old Kilpatrick stations.

Raphanus maritimus, Sm.—Reported for West Kilbride, on the authority of the late Rev. David Landsborough, D.D., in *The Botany of Ayrshire*.

Diplotaxis tenuifolia, DC.—Plentiful last autumn in an old neglected garden on the canal-bank between Old Kilpatrick and Bowling. Unlike most of the other *Brassicæ*, the leaves of this species have a very disagreeable taste. Not included in the *Clydesdale Flora*.

Arabis hirsuta, Br.—I observed a fine specimen of this plant on the roadside between Torrance-of-Campsie and Lennoxtown, on 6th October, 1883. This, I think, is the nearest station to Glasgow yet recorded.

Polygala vulgaris, L., var. *depressa*.—Common on

sandy pastures at Seamill, and probably not unfrequent along the shore of the Firth. The peculiar habit of this variety renders it liable to be overlooked, especially when growing among grass.

Malva moschata, L.—Local; plentiful a few years ago on the border of a field on the roadside opposite Dalnottar House, Old Kilpatrick, where it is probably still to be found.

Melilotus officinalis, L. } —Alien; a few plants oc-
M. alba, Lamk. } curred last summer on the canal-bank between Old Kilpatrick and Bowling.

Trifolium arvense, L.—Rather rare. First recorded for West Kilbride on the authority of Dr. Landsborough. I have gathered specimens on waste ground near the railway station, and in a corn-field at Chapelton.

Lathyrus sylvestris, L.—Recorded for Portincross, in *The Botany of Ayrshire*, on the authority of Mr. Borland, Kilmarnock. As only one station—Struey Rocks, Arran—is known for this plant in the West of Scotland, its occurrence at Portincross must, I think, have been accidental. I have certainly never been able to find it there.

Sedum villosum, L.—Local; rather plentiful on the border of a marsh on the east side of Knockewart Hill, near Ardrossan.*

* This marsh, to which I shall frequently have occasion to refer, appears to have been formerly a small sheet of water, known as "Knockewart Loch," and indicated as such on the Ordnance-survey map. With the exception of a small part along the eastern and southern margins, the abundant growth of *Menyanthes*, *Carices*, and other aquatic plants, has covered the surface of the loch with a mass of vegetation; and when viewed from the neighbouring hills it now resembles a green field rather than a lake. The western margin of the flat surface, indicating the former position of the loch, has become entirely consolidated; and although in some places the thinness and elasticity of the covering afford a precarious footing, the greater part of the surface may be walked over without experiencing more discomfort than usually attends the pursuit of marsh-botany. Numerous water-birds frequent the loch; while to the botanist it is interesting as the sole station for some of the rarest plants of the Ardrossan district.

Poterium Sanguisorba, L.—Very rare; apparently confined to the sides of the railway-cutting and embankment between Dalmuir and Old Kilpatrick stations, where it is cut down with the grass every summer. Not included in the *Clydesdale Flora*.

Circæa alpina, L.—Rare; recorded for West Kilbride on the authority of Dr. Landsborough.

Sium angustifolium, L.—Cardross; plentiful in a ditch near Chapelton, West Kilbride. Not included in the *Clydesdale Flora*.

Carduus crispus, L.—Common in the neighbourhood of Glasgow, but rather rare at West Kilbride, where it seems to be confined to one or two spots along the shore from Fairlie southwards.

Matricaria Chamomilla, L.—Rare; a few plants grew last autumn on the canal-bank between Old Kilpatrick and Bowling, associated with *M. indora*.

Anthemis arvensis, L.—Rare; corn-fields near Seamill.

Hieracium aurantiacum, L.—Not indigenous, but occurring as a garden escape in several places. Mr. D. Farquhar informs me that it grows freely on the railway embankment behind Old Kilpatrick parish church.

Campanula latifolia, L.—Locally common in the district. In many of the moist woods and glens near Glasgow, the tall racemes of this handsome plant are conspicuous in summer; but at West Kilbride it appears to be rare.

Oxycoccos palustris, Pers.—Local; occurs very sparingly in the marsh on Knockewart Hill, and on the adjacent moor.

Gentiana campestris, L.—Frequent; although preeminently a plant of elevated pastures and breezy hillsides, I have gathered small specimens on the sand-hills at Stevenston railway-station, most of them stunted owing to the dryness of the sand on which they were growing.

Convolvulus arvensis, L.—Rare in the district. Plentiful on the roadside opposite Dalnottar House,

Old Kilpatrick. Mr. L. Watt, Clydebank, informs me that it also occurs on waste ground near Dalmuir.

Echium vulgare, L.—Alien; a few small plants grew last autumn on waste ground between the canal and the river, about a mile below Old Kilpatrick.

Pulmonaria officinalis, L.—Alien; reported for West Kilbride on the authority of Dr. Landsborough.

Mimulus luteus, L.—Alien; on the side of the Duntocher Burn above Dalmuir.

Linaria minor, Desf.—Rare in the district. Abundant last autumn on the sides of the railway above Old Kilpatrick station.

Lamium intermedium, Fries.—Rather local; very abundant in fields and gardens at West Kilbride, especially near the sea-shore. It is there the most common of the *Lamia*.

Juncus glaucus, Ehr.—Local; occurs sparingly on waste ground near Clyde Ironworks.

J. maritimus, Sm.—Common along the West Kilbride coast, between Fairlie and Chapelton.

Alisma ranunculoides, L.—Rare; reported for West Kilbride, on the authority of Mr. Landsborough, jun., in *The Botany of Ayrshire*.

Scirpus Savii, Schultes.—Moist shore near Poteath Farm, West Kilbride; rather abundant from Yonderfields to Seamill, and probably general along that part of the coast.

Carex acuta, L.
C. paludosa, Good.
C. riparia, Curt. } —Not unfrequent in the district. Abundant in a ditch between the canal and river, below Dalmuir. *C. riparia* also occurs near Neilston, and *C. paludosa* on the moist shore below Fairlie.

C. limosa, L.—Mr. D. Farquhar has showed me specimens collected by him at Cardross.

C. lævigata, Sm.—Rare; Biglees Glen, between West Kilbride and Fairlie.—*Mr. Farquhar.*

C. pendula, Huds.—Local; wood behind "Bank Cottage," between West Kilbride and Ardrossan, where it attains a great size in the shade. Mr. R

Turner informs me that this magnificent sedge is of frequent occurrence in the lower valley of the Avon, and he believes that it shows a preference for spots where the soil is impregnated with iron.

Lepturus filiformis, Trin.—Rather plentiful on the moist turfy shore at Fencebay, between Fairlie and Hunterston; and occurring occasionally, in like situations, between Fencebay and Chapelton.

XX.

A WEEK AT GLEN SHEE.

BY PETER EWING.

[Read 30th December, 1884.]

In giving you my opinion of the district around the head of Glen Shee as a field for the botanical collector, it is necessary that I should say at the outset that the eight days spent there were in the beginning of August, which proved to be too late for the majority of the flowering plants.

On arriving at Blairgowrie, I proceeded by coach to the Spittal of Glen Shee. The drive between these places is one of the finest I have ever had, the configuration of the mountains, and the rich colouring of hill and dale produced by the varied vegetation, being very pleasing to the eye. The drive is no doubt long; but its distance is not felt to be too great, unless one sees, in passing, many plants which he would like to get out to obtain. *Alchemilla alpina* and *Avena pratensis*, var. *alpina*, are among the more conspicuous plants on the roadside in the course of the drive. The hotel is a very comfortable one, and stands at an altitude of about 1000 feet, at as lovely a spot as can be found in the glen. Looking almost due north may be seen the whole length of Glen Beg, a distance of about five miles. This glen is pretty wide, with heather and grass-clad hills of no great height on either side, and having at its head the far-famed Cairnwell, whose altitude is 3059 feet. I was surprised to hear the passengers on the coach talk of going over the Cairnwell as we hear sailors speak of rounding the Cape. This is owing to the very sudden ascent on the Braemar Road, and two

very sharp turns, termed the "Devil's-Elbow," on the passage over the shoulder of the mountain. After "dining with the coach," as it is termed, I got out my vasculum and started for a walk on the road towards Braemar. When about two miles up Glen Beg, I noticed on the face of the hill a very peculiar trap-dyke; and, when viewed from the road, the rock bore a considerable resemblance to coal, in its unusually black appearance. This I decided to examine; and on getting over the fence into a piece of wet ground, I was surprised to find a plant of the indigo-coloured speedwell, *Veronica alpina*. As I had not seen this plant in life for nearly seven years, I was very soon "on the stoop." Although this piece of marshy ground would be only about twenty yards square, I saw as many different alpine plants in half-an-hour as I have seen in the Killin and other districts in the course of a whole day. Rushes, sedges, and grasses were in great numbers, and all large and healthy. *Carex capillaris*, for instance, that we find on the Breadalbane range of an average height of 4 inches, was here growing plentifully from 12 to 16 inches. Mosses and *Hepaticæ* that I had before gathered only as straggling plants, mixed up with others, were here in large patches. On ascending the hill, which was now covered with a thick, heavy mist, I found *Pyrola secunda* growing pretty freely among the heather, but past the flowering stage; also a few other good alpine plants. My first impression of the district was therefore a favourable one.

The following morning brought with it a threatening sky and falling weather-glass. I started, however, to do the Cairnwell, and see how the road to Canlochan lay. After walking along the road towards Braemar, till within a mile of where the footpath to Glen Isla (shown on the Ordnance-survey map) meets the road, I found it impossible to discover the path or to follow its direction. It is so little used by man that the grass has completely

hidden it; but, after an ascent of about 2500 feet, it is so much used by sheep, and marked by quartz cairns, that it may not only be easily followed but makes a fine walk. This path I kept right over the ridge, till I looked down upon the great Canlochan Glen. As there was a good deal of snow lying about, and the wind was strong, the rain cold, and the mist flying in great masses, I resolved to turn back; and with the aid of my compass I made for the cairn where the three counties—Perth, Forfar, and Aberdeen—meet. I then struck in a direct line between Meall Odhar and Glas Maol, again reaching the Braemar Road about four miles from the hotel, and thus saving at least nine miles' walking. I may say here, after the experience of other two days in that region, that in going to Canlochan or Canness from the Spittal, the best way is to walk on the Braemar Road to a point about half-a-mile past the "Devil's-Elbow," and then proceed up the shoulder of Meall Odhar. In this way about 1000 feet of pretty stiff climbing is necessary, but afterwards the walk is easy. By the road first mentioned there is little to attract attention till a considerable part of the ascent has been attained, when a good deal of *Carex rariflora* and *C. Watsoni* may be observed in the boggy pools; but by the latter road a botanist can never weary. If a look-out is kept on the ascent, many dwarf willows will be seen; and when the first ridge is reached, it will be found to be literally covered with *Azalea procumbens*. In passing along the slopes, many of the rarer alpine mosses and *Hepaticæ*—notably *Tetraplodon mnioides*, with its peculiar-looking capsules, growing on sheep-dung—will be found; also as many "averns" or "cloud-berries"—the fruit of *Rubus Chamæmorus*—as one can care to eat. *Veronica alpina*, *Epilobium anagallidifolium*, *E. alsinifolium*, *Alopecurus alpinus*, and *Phleum alpinum*, are frequent in the rills, along with abundance of *Carex rariflora* and *C. Watsoni*. In coming down from Meall Odhar into Canlochan, I

crossed the patch of perpetual snow. After all the heat of the summer, it seemed about 30 yards long, 6 yards wide, and 2½ yards deep; and the sensation when standing on the snow, with a broiling sun over-head, was peculiar, to say the least of it. Here grows that peculiar moss, *Polytrichum septentrionale*, which Braithwaite regards as a variety of *P. alpinum*. I picked up a few mosses and *Hepaticæ* around the snow; but I had, ere long, to give up collecting, as I had become so cold that I could not hold my digger. The rocks were very dry at the place where I descended. Hawkweeds and willows—forms of *Salix Lapponum* and *S. Arbuscula*—were plentiful, but I did not observe *S. Myrsinites* or *S. lanata*. Among the plants occurring most abundantly were *Sagina saxatilis*, *Arabis petræa*, *Dryas octopetala*, *Potentilla alpestris*, *Veronica saxatilis*, *Carex atrata*, and *C. rigida;* but these were all past their best flowering condition. At the foot of the rocks *Phleum alpinum* is so common that one is apt to conclude that it is a very common grass. In the ascent of the rocks, on the way homewards, I chose a wet-looking place, and was much pleased to see our rarer alpine plants in great profusion. Besides the species I have already mentioned, *Erigeron alpinus* seemed pretty common; and near the top of the sand-scar there were about 10 square yards blue with *Gentiana nivalis*, with here and there *Pyrola rotundifolia* and *P. secunda*. In the crevices of the rocks the most striking moss was *Œdipodium Griffithianum*. After spending four hours among the rocks in Canlochan Glen, I came away impressed that it would be a fine place for the study of Hawkweeds; for, judging from the number to be seen there, one would think that there would be no difficulty in finding all the species and varieties described. These rocks are, on the whole, dry, and very difficult to work. Not being a geologist, I cannot describe the formation; but there appeared to be different kinds of rocks. Some parts seemed schistose, some weathered trap,

and others resembled sandstone. On the way back to the Spittal, I came over the shoulder of Creag Leacach—a course I would advise no one to follow, as I had about one mile of large quartz blocks to pass over, every edge of which seemed to be as sharp as a knife, and all I saw to interest me was a peculiar black lichen which was growing on these blocks. Canness and Canlochan Glens are very similar, and their united streams become the River Isla. Of Canness I can say but little, only having been in it for about an hour. As the walk to its head from the Spittal is pretty long, I made for the place where *Mulgedium alpinum* is said to grow, and reached what appeared from the surrounding rocks to be the eagle's eyrie. I saw an eagle, but none of the thistle. Judging, however, from what I did see of the glen, I think it is worthy of a few hours' work.

There are two fine corries on Glas Thulachan, facing Glen Tatnich—a glen to the north-west of the Spittal, in which the best plants of *Betula nana* are to be found. I may say, in passing, that the sheep seem to be particularly fond of this plant. *Hieracium calenduliflorum* has only as yet been found in the larger of these two corries; but I could not find a plant fit for collecting, all being too far gone in fruit. It is only at the head of this corry, too, that *Saxifraga nivalis* is known to grow; and I did not come upon it anywhere else, nor, I am told, did the Scottish Alpine Club. Carn Mor would also make another good day's work.

Speaking generally, this district far exceeds any place I have yet visited, as regards both quantity and quality of its alpine plants. The difficulty of getting to their habitat is *nil* as compared with the Killin district. On the opposite side of the road from the hotel, *Aira montana* and *Avena pratensis*, var. *alpina*, are common plants; while the fences and rocks are spotted with a lichen—probably *Umbilicaria fimbriata*, which grows on the summits

of Ben Lawers, Ben Laoigh, and other mountains of that range. *Draba inflata* grows about 200 yards from the hotel, *Gnaphalium norvegicum* on the road-side crossing Cairnwell—and so on. There is no mountain-climbing worthy of mention, the highest point in the district being only 3502 feet; and when it is considered that the hotel is situated at an elevation of 1000 feet, the remaining 2500 do not amount to much, even though the ascent were sudden. This however is not the case, as—with one or two exceptions—the hills are rounded on the top, and their sides slope gradually.

In conclusion, I would recommend all who desire to visit the district to go there not later than the middle of July.

XXI.

NOTES ON THE NEUROPTERA OF ARGYLLSHIRE.

BY JAMES J. F. X. KING.

[Read 28th April, 1885.]

Towards the end of June of last year I visited Argyllshire, with the intention of working up its Neuropterous Fauna, seeing that little or nothing had been done in this way by previous workers in that county.

Sron-mhail-choin, a small village near Dalmally, was selected as head-quarters during my six-weeks sojourn, from whence I made excursions to Ledaig, Tobermory, &c.

As the western portion of Argyllshire is well supplied with lochs, streams, and marshes, it might be expected in a moderately dry season to prove a good hunting-ground for *Neuroptera*, more particularly such species as pass the earlier stage of their existence in an aquatic element. Unfortunately, however, during the time I was in the district there was scarcely a dry day, which accounts for my list of captures not being so large as it would have been, had the weather been more favourable. Little or no collecting can be done during showery weather, as the trees and herbage get loaded with moisture which destroys such insects as may happen to get into the net.

About 9 species of *Psocidæ*, however, fell to my net, being nearly a third of the British list.

The *Perlidæ* and *Ephemeridæ* have not as yet been worked up, but they seem to promise well.

The *Odonata*, or dragon-flies, were very poorly represented, owing no doubt to the scarcity of sunshine; but the insects themselves were not scarce, if I can judge from those collected by Mr. W. R. Baxter for me at Ledaig, although few among them call for any special remark.

The *Neuroptera-Planipennia*, however, were fairly well represented; while I was so fortunate as to take upwards of a third of the species contained in the British list of the *Trichoptera*, including two or three that have only recently been described or recorded for Britain.

PSEUDO-NEUROPTERA.

PSOCIDÆ.

CLOTHILLA

PULSATORIA, L.—Very common in houses at Dalmally and Ledaig.

PSOCUS

FASCIATUS, Fab.—Taken in the Pass of Brander.

BIFASCIATUS, Latr.—Taken in abundance by beating the pines near Barcaldine House.

STENOPSOCUS

IMMACULATUS, Ste.—Common near Sron-mhail-choin.

CRUCIATUS, L.—Frequent at Loch-Awe-side and Ledaig.

CÆCILIUS

FLAVIDUS, Ste.—Very common almost everywhere.

PHÆOPTERUS, Ste.—Near Sron-mhail-choin.

ELIPSOCUS

UNIPUNCTATUS, Müll.—Common at Dalmally and Ledaig.

WESTWOODII, M'Lach.—Common everywhere.

ODONATA.

LIBELLULIDÆ.

LIBELLULA

QUADRIMACULATA, L.—Very common near Tobermory, and at Ledaig.

GOMPHIDÆ.

CORDULEGASTER

ANNULATUS, Latr.—Common on Ben Cruachan, near Ledaig, and in Mull.

ÆSCHNIDÆ.

ÆSCHNA

JUNCEA, L.—Common.

AGRIONIDÆ.

LESTES

SPONSA, Haus.—In abundance near Sron-mhail-choin, and at Ledaig.

PYRRHOSOMA

MINIUM, Harr.—Common all over the Dalmally district, at Ledaig, and in Mull.

ISCHNURA

ELEGANS, Lind.—Common near Sron-mhail-choin, and at Ledaig.

AGRION

CYATHIGERUM, Charp.—Common near Dalmally, at Ledaig, and in Mull.

NEUROPTERA-PLANIPENNIA.

SIALIDÆ.

SIALIS

LUTARIA, L.—Common everywhere.

FULIGINOSA, Pict.—Loch Awe.

OSMYLIDÆ.

SISYRA

FUSCATA, Fab.—Common along the side of Loch Awe, and also near Tobermory.

HEMEROBIIDÆ.

MACROMUS

PAGANUS, L.—Near Sron-mhail-choin.

HEMEROBIUS

NITIDULUS, Fab.—Taken near Sron-mhail-choin by beating herbage.

OROTYPUS, Wesm.—Common near Dalmally, and also in Mull.

NERVOSUS, Fab.—Frequent near Dalmally.

CHRYSOPIDÆ.

CHRYSOPA

FLAVA, Scop.—Frequent near Sron-mhail-choin.

VITTATA, Wesm.—Occurred with the last species.

ALBA, L.—Common near Dalmally, and at Ledaig.

CONIOPTERYGIDÆ.

CONIOPTERYX

TINEIFORMIS, Curt.—Abundant near Sron-mhail-choin.

PANORPIDÆ.

PANORPA

GERMANICA, L.—Taken in plenty near Dalmally by sweeping herbage.

In my collection I have a specimen of the variety *apicalis* of Stephens, taken by Mr. P. Cameron, near Loch Awe.

TRICHOPTERA.

Inæquipalpia.

PHRYGANEIDÆ.

PHRYGANEA

GRANDIS, L.—A female of this species was captured near Kilchurn Castle.

STRIATA, L.—Taken near Tobermory.

VARIA, F.—Very richly-coloured specimens were obtained near Kilchurn Castle, and in other localities.

OBSOLETA, (Hag.) M'Lach.—This northern species was taken somewhat freely at Loch-an-Uaine (2000 ft. above sea level), also at a lochan near Tobermory.

LIMNOPHILIDÆ.

COLPOTAULIUS

INCISUS, Curt.—Occurred commonly all over the Dalmally district.

LIMNOPHILUS

RHOMBICUS, L.—Near Kilchurn Castle.

BOREALIS, Zett.—One specimen of this very local northern species was taken near Dubh-loch-mor, Ledaig.

SUBCENTRALIS, Brauer.—This rare insect was captured in three localities near Sron-mhail-choin.

MARMORATUS, Curt.—This species was a perfect pest everywhere, a few nicely-marked forms occasionally turning up.

LUNATUS, Curt.—Occurred near Barcaldine Castle.

CENTRALIS, Curt.—Very common at Dalmally and near Ledaig.

VITTATUS, F.—Very common at Dalmally.

AFFINIS, Curt.—Occurred near Barcaldine Castle, but only rarely.

AURICULA, Curt.—Very clearly-marked specimens of this species occurred near Dalmally and at Ledaig.

GRISEUS, L.—Dubh-loch-mor, near Ledaig.

EXTRICATUS, M'Lach.—Frequently taken by beating fir-trees near Dalmally.

LURIDUS, Curt.—Common near Dalmally, Ledaig, and Tobermory.

SPARSUS, Curt.—Occurred in profusion everywhere; many beautifully-marked forms being obtained near Dalmally and at Ledaig.

STENOPHYLAX

INFUMATUS, M'Lach.—One specimen of this species was captured at a sedgy lochan near Sron-mhail-choin, thus adding another locality to the few known British ones.

ECCLISOPTERYX

GUTTULATA, Pict.—Taken at Dalmally and Tobermory.

SERICOSTOMATIDÆ.

SERICOSTOMA

PERSONATUM, Spence.—Occasionally captured at Sron-mhail-choin.

SILO

PALLIPES, F.—Very common everywhere.

BRACHYCENTRUS

SUBNUBILUS, Curt.—Beaten out of bushes along the side of Loch Awe towards the end of May.

CRUNŒCIA

IRRORATA, Curt.—Taken freely in some of the close glens near Sron-mhail-choin, by sweeping amongst the luxuriant herbage.

LEPIDOSTOMA

HIRTUM, F.—Occurred commonly with the last species.

Æ q u i p a l p i œ.

LEPTOCERIDÆ.

BERÆA

PULLATA, Curt. } —These species were taken freely near
MAURUS, Curt. } Sron-mhail-choin.

LEPTOCERUS

NIGRO-NERVOSUS, Retz.—Rare, in the Pass of Brander.

FULVUS, Ramb.—This insect might be seen disporting itself of an evening above the surface of the quieter reaches of the river Orchy; but owing to its very swift flight and its habit—or caution—in not approaching the river bank, it was but rarely captured.

ATERRIMUS, Steph.—The black and brown forms of this very common species occurred in numbers both in the Dalmally and Tobermory districts, the brown form preponderating.

CINEREUS, Curt.—Very common everywhere.

COMMUTATUS, (Rostock) M'Lach.—Somewhat frequent on the Orchy. It is worthy of note that wherever this species occurs, its nearest ally, *L. albifrons*, is seldom, if ever, taken—*L. commutatus* taking the place of the more common species. Such, at least, has been my experience.

MYSTACIDES

AZUREA, L.—Occurring in clouds along the side of Loch Awe, near Tobermory, and in Barcaldine grounds.

TRIÆNODES

BICOLOR, Curt.—This species might be taken in any quantity at the sedgy lochans, and also at the backwaters of the river Orchy.

ŒCETIS

LACUSTRIS, Pict.—Very common at the sedgy lochan near Sron-mhail-choin.

HYDROPSYCHIDÆ.

HYDROPSYCHE

PELLUCIDULA, Curt. } —Taken somewhat freely at various
INSTABILIS, Curt. } places along the side of Loch Awe.

DIPLECTRONA

FELIX, M'Lach.—I could always count on obtaining at least half-a-dozen specimens any morning by sweeping the herbage in any of the close glens near Sron-mhail-choin.

PHILOPOTAMUS

MONTANUS, Donov.—Very common along with the last species.

WORMALDIA

OCCIPITALIS, Pict.—Occurred in profusion in like situations to those in which the two foregoing species were taken.

PLECTROCNEMIA

CONSPERSA, Curt.—A few specimens were captured near Tobermory.

POLYCENTROPUS

FLAVO-MACULATUS, Pict.—Very abundant everywhere.

MULTIGUTTATUS, Curt.—Frequent at the side of the river Orchy, and near Tobermory.

KINGI, M'Lach.—Three specimens of this insect were taken near Sron-mhail-choin, thus adding a new locality to the three previously known ones.

HOLOCENTROPUS

DUBIUS, Ramb.—No stranger either at Sron-mhail or Tobermory.

PICICORNIS, Steph.—This pretty little insect was the commonest species at the sedgy lochan near Sron-mhail-choin. The specimens taken varied from a delicate, pale golden-yellow, with scarcely any markings, through various shades of golden-brown with markings of varying degrees of intensity, to a dull sooty-black. It is worthy of note that all the males taken have the anal characters similar to those that occur on the Continent, this form not having been observed in Britain before.

CYRNUS

TRIMACULATUS, Curt.—Very common almost everywhere.

FLAVIDUS, M'Lach.—Taken at the sedgy lochan near Sron-mhail-choin, the pale, bright yellow form occurring along with the dull grey one.

TINODES

WÆNERI, L.—Abundant at Loch Awe and Tobermory.

AUREOLA, Zett.—Frequent at Tobermory.

LYPE

PHÆOPA, Steph.—A few specimens were taken at Loch-Awe-side.

RHYACOPHILIDÆ.

RHYACOPHILA

DORSALIS, Curt.—Common everywhere in the Dalmally district.

GLOSSOSOMA

VERNALE, Pict.—As common as the last species.

AGAPETUS

FUSCIPES, Curt.—Common in the Dalmally district.

COMATUS, Pict.—Occurred in profusion in the grounds around Barcaldine House, also at Dalmally.

HYDROPTILIDÆ.

HYDROPTILA

LONGISPINA, M'Lach.—Swarmed along the edges of the backwaters of the Orchy, near Kilchurn Castle.

FORCIPATA, Eaton.—Common at Loch Awe.

Sp. nov.—I have a male from Mull of a species which appears to be allied to *H. pulchricornis*.

OXYETHIRA

COSTALIS, Curt.—Very common at all the stagnant pools near Kilchurn Castle,—in fact, hundreds might be taken in the net on a suitable afternoon.

XXII.

NOTES ON THE ALGÆ OF THE KILDONAN SHORE, ARRAN.

BY DAVID GREGORSON, F.E.I.S.

[Read 24th February, 1885.]

THE following notes are the result of a few days observation in the month of July last year. They are therefore limited in their extent, and so far imperfect in their character. The observations were not made under the most favourable circumstances, as the month of July is not the most suitable period for collecting many of the species; and the time at my command was too limited to enable me to take advantage of every favourable opportunity, even in that month. I was also without some of the apparatus necessary for successful work, such as means of dredging, &c.; and I had to take only those specimens that were cast up by the tide on the shore, or could be found between tide-marks at low water. I bring the result of my observations before the Society in the hope that it may form the basis for more extended work, and be the means of stimulating others to further observation.

The Kildonan shore lies along the south-east corner of Arran, and commands a wide prospect of sea, looking away out beyond Ailsa Craig. It is to some extent sheltered by the island of Pladda, situated about a mile from the shore. From Dippin-point to Bennan-Head the cliffs of the old sea-beach recede from the shore, leaving a low level strip of sandy beach, with here and there flat sandstone rocks, and broken up in all directions by numerous trap-dykes,—thus forming a very favourable situation for the growth of *Algæ*, and affording much convenience for collecting them.

Comparing this part of the coast of Arran with the west coast about Blackwater-foot and Drumadoon-point, I found at Kildonan a much larger quantity of some of the more delicate species, but not so great a variety. They grew more abundantly at Kildonan and could be more easily collected, but some species may be found at Drumadoon which are not found at Kildonan; and although Kildonan is a splendid field for the study of marine objects, both animal and vegetable, yet a visit to Drumadoon, after a strong south-west gale, would well repay the trouble by the greater variety likely to be found there.

The following is a list, arranged in the usual order of classification, of those *Algæ* seen or collected:

MELANOSPERMEÆ.

Halidrys siliquosa.—Abundant, and varying much in size.

Fucus vesiculosus., *F. serratus.*, *F. nodosus.*, *F. canaliculatus.*—These species are abundant, as on nearly all our coasts, and very prominent from their luxuriant growth, some of the air-cells of *F. nodosus* being as large as a hen's egg.

F. ceranoides.—Not common. I may remark that this species is found abundantly at Fairlie, on the Ayrshire coast.

Desmarestia aculeata.—Frequent.

Alaria esculenta.—Frequent, and in good condition for showing the spore-bearing parts of the fronds.

Laminaria digitata., *L. bulbosa.*, *L. saccharina.*—Common, and of large size.

Chorda filum.—Abundant.

Dictyota dichotoma.—Frequent, but not well-grown.

Dictyosiphon fœniculaceus.—Frequent.

Asperococcus compressus.—Common.

A. echinatus.—Common.

Chordaria flagelliformis.—Common.

Mesogloia vermicularis.—Common.

Cladostephus verticillatus.—Frequent.

C. spongiosus.—Frequent; may be mistaken for *Codium.*

Sphacelaria cirrhosa.—Frequent, appearing as round balls floating in the sea.

Ectocarpus.—Several species of this genus abundant. I collected some of them, but did not name them.

RHODOSPERMEÆ.

Odonthalia dentata.—Abundant. This species is not found in the South of England.

Polysiphonia Brodiæi.—Frequent.

P. nigrescens.—Common.

P. parasitica.—Not common, but may have escaped notice.

P. elongata.—Not common.

P. fastigiata.—Common on *Fucus nodosus.*

P. byssoides.—Not common. I collected a number of species of this genus, but was not able to name them.

Dasya coccinea.—Frequent.

Bonnemaisonia asparagoides.—Rare; more frequent at Drumadoon.

Laurentia cæspitosa.—Frequent, but small in size.

Lomentaria kaliformis.—Common, but not in good condition.

Corallina officinalis.—Abundant.

C. squamata.—Less common than preceding.

Delesseria sinuosa.—Abundant.

D. alata.—Common.

D. ruscifolia.—One small specimen found.

Nitophyllum punctatum.—Frequent.

N. Bonnemaisonii.—Frequent, and very variable.

N. laceratum.—Abundant.

Maugeria sanguinea.—Frequent, but not in good condition; perhaps too late in the season to find it fresh.

Rhodymenia palmata.—Common.

Rhodophyllis bifida.—Not common; but small in size, and may be overlooked.

Plocamium coccineum.—Common.

Cystoclonium purpurascens.—Frequent.

Callophyllis laciniata.—Common, and in good condition.

Gigartina mamillosa.—Frequent.

Chylocladia articulata.—Frequent, but very small.

C. clavellosa.—Not common.

Furcellaria fastigiata.—Frequent.

Schizymenia edulis.—Not common.

Gloiosiphonia capillaris.—Not common, but apt to escape notice.

Dumontia filiformis.—Common, and very variable.

Ceramium rubrum.—Common, and variable.

C. decurrens.—This may be a variety of the preceding species.

Ptilota plumosa.—Very common.

P. elegans.—Not so common.

Griffithsia setacea.—Frequent.

Callithamnion tripinnatum.—Rare; from its small size it may escape notice

This is an extensive genus, but I have not hitherto given it much attention.

CHLOROSPERMEÆ.

Codium tomentosum.—Large size, not common; small size, common.

Porphyra vulgaris.—Frequent, but not in good condition.

Enteromorpha intestinalis.—Common, where fresh water flows into the sea.

E. compressa.—Common.

E. clathrata.—Common.

Ulva Linza.—Frequent.

U. latissima.—Common.

Cladophora arcta.—Common.

C. rupestris.—Common.

Another extensive genus, to which I have not yet given much attention.

I hope that a few more of the members may be induced to begin the study of the *Algæ*, and that this list may be greatly increased. One or two special excursions might be useful in helping beginners.

The usual way of mounting is on the wet paper, and as soon after collecting as possible; but more time and convenience are required for this process than can sometimes be spared. I append a few hints from Mrs. Gatty's book on Sea-weeds that may be found useful.

Take an old towel, on which put a row of the sea-weeds as they are collected; then fold the towel over the row of weeds, and repeat till the towel is full. The sea-weeds may thus be carried in towels, and kept for a day, when they can be laid out in the usual way.

Another method is to spread out the sea-weeds on newspapers on the floor of an airy room, but not in the sun, and turn them occasionally till dry, when they may be packed up loosely in paper bags. They will keep for a considerable time in this condition; and when laid out they can be moistened, and made like freshly-gathered weeds. This plan is well-suited for the coarser kinds; but for the more delicate species no method succeeds so well as mounting them whenever they are collected.

XXIII.

THE EXTERNAL CONFIGURATION OF PLANTS IN RELATION TO WIND PRESSURE AND WATER CURRENTS.

BY ALEX. S. WILSON, M.A., B.Sc.

[Read 28th April, 1885.]

NOTWITHSTANDING the infinite variety of vegetable life, the bodily shapes of plants are not without their significance. The correspondence between a plant's external configuration and its environment, although recognised by all in a general way, is not usually held to extend very far. The shapes of organic beings in many instances are so strange as to give the impression of arbitrariness; and even naturalists are prone to ascribe them to the influences of heredity and variation, or whatever unknown agencies these terms may cover. As knowledge advances, however, the forms of living things must become more and more intelligible, and the correspondence between organ and environment be traced further and further into the details of shape and structure. No one can fail to remark the way in which the bodies of animals are adapted to the medium in which they live,—a bird's body, for instance, is fashioned in correspondence with the air through which it moves,—the external form of a fish is related to its aquatic existence, while the shape of a land animal is determined in relation to the atmosphere it breathes and to the earth's surface which it treads. The adjustment of organic forms to their immediate surroundings often fails to impress us, from our habitually taking for granted the existence of such a relationship. We become sensible of its extent and importance when a transposition takes place, as when a land animal

is drowned, or a fish taken out of the water dies. A land animal is incapacitated for an aquatic existence, not only by the possession of lungs instead of gills, but also by the shape of its body and the form of its limbs. If the ancestors of existing marine mammalia—the whales and porpoises—were originally land animals whose descendants have been specialised for an aquatic mode of life, then it would appear that the transformation had been accomplished without any radical change in the organs of respiration; but the external form of the body and limbs has undergone extensive alteration. The bodily contour is thus of greater importance than might have been supposed. "Nature," says the poet, "hath framed strange fellows in her time;" but perhaps, if we knew the difficulties with which each "fellow" has to contend, his physiognomy might not seem so strange after all. A mermaid is a natural enough conception, if she be supposed to live with the upper portion of her body always in the air and the lower part always submerged. Suppose such a form entirely submerged, or entirely out of water, and it becomes unstable and grotesque. There is a regulation uniform in the domain of Neptune, and all who acknowledge the Sea-god's sway must conform to the fashion of his court. This obligation is quite as imperative for plants as for animals. Consider the effect of making a marine plant change place with a terrestrial one. The sea-weed finds all the food it requires in the surrounding water; it has no need therefore of a root to absorb water and mineral salts. Accordingly, were we to transplant it into a garden, it would be unable to extract sufficient water or mineral substances from the soil to support its existence. The branched base of a sea-weed is not a root in this sense at all: it merely serves to fix or anchor the plant, and thus prevent the waves from dashing it to pieces on the shore. Again, marine *Algæ* have no stems, in the ordinary sense, and cannot as a

rule stand erect in air. They need the support of the dense sea-water to buoy them up, aided, in the bladder-wrack, gulf-weed, and others, by the presence of air-bladders or floats. In the atmosphere these would be quite useless in the way of affording support, and the surface of the plant could not be fully exposed to the sun's rays. Even were this difficulty overcome—if a sea-weed by some means could acquire rigidity,—yet, being destitute of leaves, in the ordinary sense, it could not draw up water into the higher portions of the frond. A moss, for example, when dry may be moistened at one point without the moisture passing into the other parts. In the higher plants the ascent of the sap depends mainly on the amount of evaporation which takes place from the surface of the leaves. In a sea-weed there is no such provision; any internal circulation of fluid that occurs must be due simply to chemical reactions taking place in the cells, and to endosmose. Such circulation cannot be other than sluggish, and quite insufficient for plants living in an atmosphere not saturated with moisture.

By way of contrast, consider how ill adapted for growing on the sea-bottom is an ordinary tree like the oak or elm. Its roots could get but a feeble grasp of the rocky sea-bed; and they would no longer be of use for absorbing water and mineral salts if the whole tree were submerged. The rigidity of the stem and branches would also prove disadvantageous; and from the great resistance offered to the waves, the branches must in all likelihood be wrenched off. Even an unbranched stem, like that of the palm, would simply be a lever enabling the currents easily to uproot the tree. The preservation of a submerged forest must therefore be quite an exceptional thing, only possible where the trees have been rooted in tenacious soil and the waters quiet. Even in such favourable circumstances it must be rare to find an erect trunk of any considerable height. From their fragile nature, the leaves of a submerged

tree must soon be stripped off or torn into shreds; and even in still water they could hardly prove of any use to the tree, because ordinary leaves are specialised, not for the purpose of absorbing water, but to eliminate it. As soon, however, as a leaf is submerged, evaporation must cease, and with its cessation the circulation of the sap within the stem and branches comes to a standstill. Add to all this the low specific gravity of ordinary wood, tending to float the tree away, and it will be seen that an oak growing on the sea-bottom is an impossibility. A sea-weed in garden soil would be like a fish out of water, and a tree under water is quite as much "out of its element." We see, then, that in land plants the differentiation of the plant-body into leaf and stem is a necessity arising out of the low density of air compared with water. The axis of a land plant must be massive and rigid; flexibility is of advantage to one growing in water. The leaves of a terrestrial plant must necessarily be light in order to float in the rarer medium. Terrestrial plants have a further relationship with the soil from which water and inorganic matter have to be taken up. For this purpose an organ has been specialised in all the higher plants—the root. The root also fulfils the function of fixing the plant in one place; but the mode of attachment differs strikingly from that observed in marine plants.

The foregoing illustrations may serve to put the reader's mind in the proper attitude for pursuing the investigation before us. One other remark of a general character may be made.

The external forms of plants are of greater physiological importance, and are, on the whole, less varied than those of animals. This arises from the circumstance that the food of plants is absorbed by the external surface. Plants are uniformly destitute of a stomach or alimentary canal. The body of one of the higher animals may be regarded as consisting of two concentric cylinders—the outer one repre-

senting the external surface of the body, the inner one the digestive system, with the perivisceral space between. An alimentary system is thus a contrivance whereby the superficial area of an organic body may be extended without any addition being made to its mass. This means of extending the absorbing surface is not available in the case of plants, since their nutrition depends on the free access of light, which would be unable to illuminate an internal cylinder. In the pitchers of *Nepenthes* and other carnivorous plants we have an exceptional form which corresponds with their exceptional mode of procuring nourishment. Two animals which outwardly resemble each other very closely may yet have very different habits and subsist on totally distinct kinds of food. In such cases an examination of their alimentary systems is needed to reveal the differences which separate them. But the case is different in plants, whose organs of nutrition are external. The outward configuration of the plant-body is therefore of greater significance. For the same reason the extent of external surface is usually greater in proportion to the mass of the body than in animals—for example, the area of leaf-surface alone in an elm has been computed to be five acres. No animal ever existed with an external surface at all to be compared with this. This great superficial area is a necessity arising out of the mode of assimilation that obtains in vegetable organisms.

In our endeavour to trace the relationships subsisting between the contour of plants and their environment it will be convenient to begin with some common types.

1. The Spherical Form.—The chief representatives of this form in the vegetable world are of small size—of microscopic dimensions, in fact. The spherical shape is indeed incompatible with great mass, because it affords the least possible area of absorption in proportion to the mass. Spherical plants accordingly consist mostly of a single cell, or

of a few cells. The öospore from which a plant is developed is, however, a spherical body, and, were it to develop equally in every direction, must inevitably give rise to an adult plant of the same shape. At an early period of development, however, an *axis of growth* may be discerned in most plants. We are unable to explain why the growth of the embryo is restricted to particular directions, but the utility of this restriction will become sufficiently apparent as we proceed. The judicious pruning away of certain parts—the arrest of development in one direction—seems to be as essential to advancement of organisation as is the free and full development in other directions. These limitations to growth, so necessary to the specialisation of organs, may possibly be the result of an internal struggle going on among the parts of the same organism. Be this as it may, the spherical shape is one singularly disadvantageous to vegetable development. The spherical shape of such plants as *Echinocactus* is only an apparent exception to this rule. In this case the form of a sphere has been assumed as a provision to counteract the adverse conditions in which many of the *Cacti* live. Exposing the least surface to the atmosphere possible in proportion to the mass, these spherical plants must assimilate slowly; but there is this compensation that the amount of evaporation is reduced to a minimum—a consideration of the utmost importance to plants inhabiting arid countries. From the fact that the amount of evaporation depends on the extent of surface exposed to air, the spherical form is the best adapted for retaining water. In this connection we may refer to the typical form of a leaf, which is also very largely determined in relation to the elimination of the water absorbed by the roots. A typical leaf consists of a thin expanded plate or lamina, with or without a leaf-stalk. This shape affords a very large extent of surface; and when the numerous stomata and amount of water daily transpired by leaves are

taken into account, the substance of the leaf is seen to be disposed with a view to promote evaporation. One applies the same principle when his coat has got wet. It would take a long time to dry if it were tightly rolled up into a bundle, compared with the time necessary if the coat be spread out and hung up. When a plant grows partly in water and partly in air there is a remarkable difference between the submerged leaves and those produced on the aerial part of the stem, the former being divided into linear thread-like segments. The aerial leaves of *Ranunculus heterophyllus* bear the same relation to its submerged dissected leaves that the web-foot of a duck does to the toes of a hen. The dissected leaf has the advantage of offering less resistance to water currents.

2. The Discoid Form.—An organism originally spherical may depart from that shape in various directions. It may pass through the ellipsoid or ovate form to the conical and cylindrical. As instances of the cylindrical, the rod-like *Bacteria* and the filamentous *Confervæ* may be mentioned. To this type we may also refer *Chara*, *Equisetum*, *Juncus*, and the trunks of most trees; but it seems probable that in the discoid forms of many Lichens and *Algæ* we have a more primitive type. If, in the developing öospore, we suppose that growth, instead of taking place equally in every direction, is restricted to one plane, and, instead of being dominated by a single axis, occurs in the radii of a circle, then there is produced, from the original sphere, a flat circular or plate-like form. This disc shape is unobjectionable so long as the plant can grow appressed to soil or rocks. Where, however, the plant cannot command a large enough free space, it will be forced to assume a vertical position. In such circumstances it is impossible for the plant to attain any very considerable dimensions while continuing to retain its circular form. Fór one thing, the resistance of the soil or sea-bed will prevent the development of

the lower semicircle. The plant will thus be reduced to a semicircular or *fan-like* form, examples of which are to be found plentifully among marine *Algæ*. Even with this fan shape, however, no great individual development is possible, because it would offer too great mechanical resistance to water currents if the plant were aquatic, and to the wind if it were terrestrial. To obviate this defect we have a further adaptation.

3. The Digitate Form.—If growth do not take place along every radius of the fan, but be restricted to a few radii, then the digitate or hand-shaped frond results, which has the advantage of greatly reducing the resistance to wind and waves. This is exemplified in the leaves of the palm, and in the fronds of *Laminaria*.

4. The Oblong Form.—This may be conceived as derived from the fan-shape by the preponderance of growth in the perpendicular radius. Such a variation from the semicircular shape would be of advantage where there was a deficiency of light, as for example in deep water. The oblong shape, unless very long in proportion to its breadth, could attain no great size without becoming liable to the same objection as the fan-shape—viz., offering too great mechanical resistance to wind and water currents. Possibly the large leaves of the Banana represent the superior limit of size which is safe for such a form in terrestrial plants. The shovel-shaped or slab-like trees of Assyrian sculptures could never have stood in a breeze of wind.

5. The Pinnate or Feather Form.—The divisions introduced into the oblong to reduce resistance give rise to the pinnate form. This is a common pattern among leaves, *e.g.* Cycads, Ferns, Umbellifers, &c. Sachs observes that, speaking generally, small leaves are undivided, while large leaves are mostly much divided. It is reasonable therefore to suppose that their divisions may to some extent be a provision against injury by wind. Since the fall of the Tay

Bridge, engineers have been compelled to take account of wind-pressure in their calculations. The subdivision of leaves may in many cases have been determined in relation to the same end.

6. Branched Forms.—Leaves belong to the discoid type since their subdivision takes place in one plane. The branching of a stem, on the other hand, occurs in several different planes. In the majority of trees the general contour or outline is spherical. The spherical contour is what we should naturally expect as the development of a globular öospore. The subdivision of the sphere is necessitated by the plant's dependence on air and light; but the branches going off alternately, in different planes and at different levels, offer no great resistance to the wind, which readily finds a passage through the tree. In very tall trees with columnar stems we have a departure from the spherical contour calculated to endanger stability. The elongated trunk simply gives the wind a more powerful lever for its overthrow. Especially is this true when there is a large expanse of leaf-surface at the apex of a lofty stem. Hence the cylindrical form is more frequent among herbaceous plants of no great size, growing together in masses, than among lofty trees. Flat-topped herbs and shrubs are common, but flat-topped trees are rare. The palm stem has evidently acquired exceptional tenacity and elasticity to meet this emergency. The case of the pine is perhaps more difficult to explain, especially when we consider the immense height attained by some species, and the exposed situations where they grow. It is impossible, however, to regard a pine-tree attentively without being struck with the disproportion in thickness between the stem and the branches. You find no very thick boughs on a pine-tree, such as abound on the oak, beech, and elm. Moreover, in the pine tree the lower branches are very much larger than the upper, and the tree tapers rapidly. Like close-clewed topsails, the needle-shaped

leaves offer but little resistance to the air. When these things are taken into consideration, it may well be that the pine is much better adapted for resisting the force of the wind than ordinary trees where the primary stem divides into numerous large branches.

The ramifications of the root are of the utmost importance in relation to wind-pressure. While extending the area of absorption, the branches of the root enable the plant to take a firm grasp of the soil. A turnip-like root would be quite incapable of keeping in position a plant that exposed a large surface to the wind. The adventitious roots of the screw-pine, which form a pile of props surrounding the base of the stem, and give the tree a conical outline, must greatly increase the tree's stability by extending the base on which it stands. The mode of attachment common in marine plants is quite unsuitable for those which grow among earth. A sea-weed does not bury its roots. In many *Algæ* the base of the frond simply expands into an adhesive disc, which attaches itself by a kind of cement to stones. A sucker-like root of this kind, adhering to the friable earth, would give no stability to a terrestrial plant. The adhesive discs at the ends of the tendrils of the Virginian-creeper show that this plan may be of service in climbers where the suckers are attached to rocks or walls, but it would be useless as a means of attachment to ordinary soil.

The geologist starts with a plane of marine denudation, and traces back to the erosive action of water, mountains, valleys, and all the existing features of the land-surface. In like manner the botanist, starting from the primitive spherical form, may yet succeed in showing that all the varied patterns of the vegetable world have been cut out by the operation of natural forces. Natural agencies, acting on organisms originally spherical, might carve them almost into any shape. It is quite conceivable, therefore, that the forms of existing plants, varied

as they are, have resulted from a gradual process of erosion not unlike that with which the geologist is familiar.

The botanical problem is complicated by several considerations, so that the parallel between natural selection, which eliminates the ill-adapted forms, and denudation which removes the softer strata, can only be said to hold in a very general way. The formation of adventitious roots by a cutting or slip when placed in moist earth is an instance showing how external agencies which have had to do with moulding the outlines of plants, react on the internal forces of the organism. The laws of symmetry and inheritance are equally obscure. All, therefore, we can hope to do at present is to direct attention to some of the more obvious examples of adaptation.

I. Thallophytes. The mycelium of a fungus has no definite shape, but consists of a network of filaments ramifying through the nidus in which it grows. Not being exposed to the action of wind or water, the vegetative part of a fungus exhibits no adaptation in relation to these agencies; it is only in the reproductive system we can hope to discover shapes fitted to resist their action. The small size of most fungi, and the sheltered places in which they grow, render it improbable that among them we should find any striking examples of adaptation in relation to the wind. Nevertheless the prevailing umbrella shape, so typical of the larger fungi, admits of an easy explanation, and illustrates the principles we have been endeavouring to explain. The shape of a mushroom is such as to protect the hymenium from rain, and at the same time admit the wind underneath to carry away the spores formed on the under surface of the pileus. Ventilators on the tops of buildings and chimney-cans are often fashioned on the same pattern.

The Lichens, which botanists now consider to be the result of symbiosis, include a number of forms

clearly adapted for growing in exposed situations. *Lecanora* and *Parmelia* afford examples of the discoid type. The filamentous thallus of *Alectoria*, the shrubby *Cornicularieæ* and *Roccellæ* growing on the trunks of trees and on rocks exposed to the violence of the wind, exhibit a marked contrast to the foliaceous *Stictæ* and *Peltideæ* which occur among moss in more sheltered positions. The shaggy appearance of the "Norseman's Plume"—a lichen which clothes the trunks of trees in the Highlands—is doubtless assumed for the purpose of lessening the resistance which the plant offers to the storm. Microscopic organisms would seem from their minuteness to be able to set at defiance the rules to which the larger plants and animals must conform. At any rate, it is among the minuter forms of life that we meet with the greatest variety. The fantastic shapes of the *Rotifera*, the exquisite sculpturings of the *Polycistinæ*, the mathematical figures and delicate markings of the *Diatomaceæ*, are without parallel among the larger organic forms, and appear to result from the operation of forces far other than those we are now considering. It would indeed seem that in the elaboration of these tiny organisms Nature had called into requisition her finest tools, and employed her most skilful artists. Looking to their extraordinary beauty and variety, we may well be tempted to despair of explaining them by mechanical laws. A suggestion of Professor E. Ray Lancaster's is, however, worthy of consideration. This eminent observer is inclined to regard minute size as affording a strong presumption of degeneration. There are not wanting reasons for thinking that the *Rotifera* are degraded crustaceans, and the mites degenerate spiders. Degeneration in the vegetable kingdom has not yet received much attention. It is quite possible that the minute size of the microscopic *Algæ* may partly be the result of their shapes. Apparently to a great extent they are exempt from the laws which regulate the shapes of larger organisms, but this exemption

would appear to be purchased at the expense of their size. The small resistance they offer to the coarser inorganic agencies seemingly allows the finer forces of the organic world to have free play, and thus it comes that the smallest organisms exhibit the most beautiful designs with which in Nature we are acquainted. Physical forces have certainly a good deal to do in determining the limits of size to which the larger organic forms attain—the height of trees, as we have seen, is limited by the force of the wind; it is at least probable that the same mechanical principles are concerned in determining the size of the smaller organisms. Many of these minute forms of life are pelagic in habit—that is, they are not confined to one place, but drift about in the sea at different depths. Fixed organisms have greater need to be adapted in relation to currents than those which drift. The fixed diatom *Exilaria flabellata* is a good example of the fan type. The disc is exemplified in *Micrasterias*. The boat-shaped diatoms *Navicula*, *Navicella*, and *Fragilaria*, afford as good an illustration as can be found in the vegetable kingdom of an external configuration which reduces mechanical resistance to a minimum. Many of these diatoms have the power of moving through the water by some unexplained mechanism. The shuttle-like shape is calculated to increase their speed and economise their power. *Volvox*, another locomotive *Alga*, is spherical in form and has a rotatory motion. From its shape, a rectilinear movement like that of *Navicula* would hardly be possible. One of the largest fresh-water *Algæ* is the filamentous *Lemania fluviatilis*. It grows in swift-running streams, often on the edges of cascades. One cannot help wondering at its ability to bear the force of the water without being swept away. Its tough knotted filaments spring from a cartilaginous disc, so firmly applied to the rocks that it requires considerable force to detach the plant. Reference has already been made to the larger marine *Algæ*. In studying them, the

depth of water in which they grow must be taken into account. The force of waves is confined to the superficial layers of the ocean, and diminishes inversely as the square of the depth. Hence, in deep water the surface may be greatly agitated, while at bottom scarcely any motion is perceptible. Every visitor to the sea-side must have remarked to what an amount of tugging and straining a sea-weed is subjected by the waves. The Flora of the strip of shore which lies between high and low water marks presents a very different appearance from that of the zone included between low-water mark and ten or fifteen fathoms. The latter zone is characterised by the presence of the larger *Laminariæ* and *Fuci*. The long tangle is not well adapted for growing in the shallow water between tide marks. There would be the greatest danger of the surf beating its broad fronds into shreds. *Laminaria*, both on account of its size and the weaker texture of its frond, is more suited to the stiller depths beyond low-water mark. The *Fuci* of the higher shore are smaller, stouter, tougher in texture, and better fitted to live in the rougher water of the beach. Beyond fifty fathoms, owing to deficiency of light and heat, there is little marine vegetation. The Corallines and Nullipores alone extend much further; and in the abyssal depths we still meet with Diatoms. On the shore, then, we observe a gradual diminution in size of the plants, not unlike what we notice in ascending a mountain; but on a mountain the temperature diminishes as the wind-pressure increases, while on the sea-bed as the temperature diminishes the force of the waves also decreases. From the small size of mosses we should hardly expect any great specialisation in relation to wind. If, however, we compare the urn and the scale-mosses, we cannot fail to note a remarkable difference, which proves that even among the mosses this element has not been without its influence in determining their shapes. The stalk, or seta, which bears the capsule in the

ordinary hair-moss, is remarkable for its strong, wiry character, and is eminently adapted to resist the wind. This kind of seta is characteristic of the urn-mosses, many of which grow in very exposed positions indeed. Their spores occur in the capsule unaccompanied by elaters. Owing to the exposed position of the plants, elaters are apparently not required to disperse the spores. But it is otherwise with the *Jungermanniæ—Pellia*, for example, which grows in sheltered places, has the stalk thick, succulent, weak, and in no way fitted to resist a strong breeze. Accordingly, in the *Hepaticæ*, the spores are provided with numerous elaters; these being rendered necessary from the wind, in the sheltered situations where these plants grow, being insufficient to secure the dispersion of the spores. In *Nitella* and *Chara* the shape of the plant-body is such as to offer but little resistance to water currents. The former is strengthened by the deposition of carbonate of lime in the walls of its cells, which also happens in the Corallines before referred to. The twisted cells forming the cortex of *Chara* are of interest as illustrating a principle which is frequently discovered in vegetable structures, viz., strengthening by means of torsion. Darwin, in his work on climbing-plants, considers that a stem gains in rigidity by becoming twisted, on the principle that a much-twisted rope is stiffer than a slackly-twisted one. In accordance with this view, the spiral thickening of the walls of cells and vessels should be explained as a contrivance for securing greater rigidity.

II. Vascular Cryptogams. The more common British Ferns grow in sheltered ravines or in rock crevices. The leathery texture and flexibility of the Hart's-tongue may possibly be a compensation for the undivided frond. The common Brake, growing on exposed hill-sides, is admirably adapted to resist the wind. The rigidity of the stipes is great in proportion to its thickness, and the numerous sub-

divisions of the frond allow free passage to the wind. But undoubtedly the graceful forms of the tree-ferns offer more striking examples than any to be found in our climate of plants admirably adapted to do battle with the storm. The divided feathery fronds crowning the tall slender stem, and the elegant palm-like habit, cannot fail to excite admiration. If possible the internal structure is more interesting still; for the vascular system of ferns, forming what is called a "netted cylinder," is an example of the lattice-girder principle. The vascular framework of a fern reminds one of the tall signal-posts of iron lattice-work so common on all our railway lines. In ferns the vascular system is reinforced by schlerenchymatous structures formed in the ground tissue of the stem and stipes. The minute internal structure of the fern is perhaps one of the most astonishing things which the microscope has disclosed.

From our present point of view both the external form and internal structure of the *Equisetaceæ* are highly instructive. In this order there are several mechanical contrivances intended to enable the plants to sustain the force of the wind. *Equisetum sylvaticum* looks like a miniature fir-tree, and the unbranched species bear a strong resemblance to rushes and grasses—plants highly specialised in this respect. The surface of the stem of *Equisetum* is ribbed or fluted. Now, while the strength of a column depends on the area of its transverse section, it is well known that in columns of equal section the fluted column is stronger than the smooth one, because each ridge acts somewhat in the same way as a stay or buttress. The ridges on the stem are caused by the fibro-vascular bundles, which are arranged in a circle. The peculiar way in which these bundles anastomose at the nodes of the stem is highly advantageous, and must contribute greatly to the strength of the stem. This uniting or anastomosing of the bundles serves to brace together

the internal framework of the stem, much in the same way as in the netted cylinder of ferns. The deposition of silica in the cells of *Equisetum* no doubt greatly adds to the rigidity of the stems and branches. Judging by their shapes, we should infer that the ancient *Calamites* could bear more exposure than the *Lepidodendra*. The latter, we are inclined to think, were not adapted for growing in exposed situations; the larger species were probably confined to low elevations.

III. Phanerogams. The *Coniferæ* have been referred to in an earlier part of this paper, but before passing from the Gymnosperms we may notice the remarkable *Welwitschia*. In this odd-looking plant the leaves may be said to be absent, their function being performed by the large persistent leathery cotyledons. There is properly no stem, but only the greatly thickened hypocotyledonary axis. The plant in fact retains in its adult state the form commonly seen in the embryonic stages of flowering-plants. A plant of this pattern could never attain great size, and yet the close resemblance of the embryos and seedlings of the higher plants to *Welwitschia* would seem to point to some such type as the progenitor of existing phanerogams. The leaves of Monocotyledons call for notice, because, with the exception of the palm-leaf, they do not generally exhibit that subdivision of the leaf-blade so common among Dicotyledons. The parallel veins, which constitute the vascular system of the leaf, are closely related to the vascular system of the stem; indeed the leaf is only a stem flattened out to adapt it for its peculiar function. In most cases the flattening occurs in a horizontal plane, but in *Iris* we have it taking place vertically. The parallel veins appear to have prevented the division of the leaf from taking place in a pinnate manner; and, where the necessity for diminishing resistance has arisen, the end has been gained either by palmate division, as in palm leaves, or by elongation into the linear or

cylindrical form, as in grasses, sedges, and rushes. The whip-shaped yielding leaves of grasses are well adapted to sustain and distribute the shock of the wind. In *Iris*, and like forms, the two-ranked or distichous arrangement of the leaves exposes a large surface to the wind; but the flexibility of the leaves, as well as their strong tough character, may up to a certain point neutralise this disadvantage. Sir John Lubbock has recently published in the *Contemporary Review* a most interesting article on leaves. In that article he has considered the arrangement of leaves in relation to light. He also compares the weight of the foliage with the thickness of the branches. He is of opinion that the dissection of submerged leaves does away with the necessity for an internal framework of vascular tissue; at any rate there is a total absence of fibro-vascular tissue in the submerged leaves of aquatic plants. Of course it is the diminished mechanical resistance which makes the framework unnecessary. The case of the lattice-leaf plant, *Ouvirandra fenestralis*, cannot be so explained. Here the parenchyma of the leaf is deficient, and apparently it is the skeleton only which is developed. The plant is a native of Madagascar, grows in streams, and is allied to our *Potamogeton*. Though fragile in appearance, its leaf is by no means delicate or easily injured. The perforations are probably of advantage in allowing the water to pass through; from the shape of the leaf they can hardly be required to allow gas to escape. The solution of continuity observed in the large perforated leaves of *Monstera* may possibly be of service in a similar manner. The large orbicular floating leaves of water-lilies, as exemplified in the well-known *Victoria regia*, are supported by the water; and their great size would lead us to infer that the weight of the leaf in the majority of plants has been an important element in limiting its size. Sir John Lubbock thinks that the advantage possessed by the palmate leaf is that

it brings the centre of gravity nearer the point of support. One striking example may be quoted from his article in support of the views advanced in this paper regarding the use of the subdivision of leaves. The mountain-ash has compound pinnate leaves, while the other members of the genus *Pyrus*, to which it belongs, have simple undivided leaves. Sir John can only account for this by the fact that the mountain-ash grows on bleak exposed situations. The unsteadiness of the aspen leaf is proverbial, but is easily explained by its thin laterally-compressed petiole. Lyrate leaves, and those having large terminal lobes, like *Heracleum*, are set in motion by the slightest breeze. The fact has sometimes been remarked that more trees are overturned by a violent storm occurring before the leaves have fallen, than later in the year when the trees have become bare and leafless.

A brief reference to the morphology of stems must suffice for the present. Various terms are employed to describe the transverse sections of stems, *e.g.*, *terete*, *compressed*, *square*, *triangular*, *fluted*, &c. In order properly to compare the powers of resistance to lateral strain of these various forms, we should require to leave out of account differences due to consistency of material, and consider only its amount and distribution, although it is certain that the resistance of stems to a breaking or bending force depends mainly on the consistency of the materials composing them. As we have already seen, the strength of a column is proportionate to the area of its transverse section. The round or terete stem, which exposes the least surface to the wind in proportion to its thickness, is to be preferred. The compressed stem is the weakest, and is weak in proportion to the difference between its two diameters. Compressed stems are not common. The scape of the daffodil may be taken as an example. This plant usually grows in situations somewhat exposed to the wind. Few flowers have a

more ungainly stalk than the daffodil. Its thickness, in proportion to the flower it bears, is much greater than we should expect. By way of contrast we may compare the slender elegant stem of the *Anemone* or *Chrysanthemum*. No doubt the daffodil stem is weak and succulent, but part of its thickness may be due to its compressed form. We often find mints and *Carices* growing together in marshes, the tall stems of the *Carex* affording shelter to the shorter mints. In these circumstances it is difficult to resist the conclusion that the triangular stem of *Carex* possesses some advantage over the square stem of the mint. In the case of the nettle, if there is any disadvantage attending the square stem, this is abundantly compensated for by the strength of its fibres. The wiry stems and small leaves of the purging-flax are in keeping with its windy habitat. Our heaths are also noteworthy on account of their strong wiry stems and small leaves. *Thalictrum*, from the consistency of its stems and the divided character of its foliage, is well fitted for growing in exposed places. The common *Plantago lanceolata* is especially deserving of mention. Its stiff fluted stem, remarkable for its beautiful spiral vessels, is exceedingly well suited to the open wind-swept pastures where it grows. It attains a much greater height than the allied *P. major*, which is not so well adapted to the wind.

No one can fail to remark that plants such as orchids and hyacinths, with succulent herbaceous stems, affect secluded and sheltered situations. In autumn the grasses undergo a remarkable change, losing their succulence, and assuming a dry and wiry character. This desiccation is partly due, no doubt, to the wind, but it also adds to their elasticity. The hollow cylindrical stems of grasses are said to have suggested to Stephenson the design of the Britannia Tubular Bridge. A hollow cylinder is very much stronger than a solid column of equal weight. The wheat-stalk is thus constructed in

strict accordance with mechanical principles. The strength of a hollow cylinder is greatly augmented by thickened bands passing round it at intervals, as these prevent the collapse of the cylinder on the side where the greatest strain happens to fall. The knotted stems of the bamboo and other grasses, of pinks, geraniums, &c., afford interesting illustrations of this. In many grasses no two internodes are exactly in the same straight line. The adjacent internodes are observed to form an obtuse angle with each other at the joint. The effect of this arrangement is rather curious. When a gust bends the stem, the result is not that the stem simply vibrates in one plane, but the linear motion produced by the wind is resolved, as if by a crank, into a circular movement of circumnutation. This is doubtless of service in promoting symmetrical growth by drawing the sap up every side of the stem. The power which grasses have of recovering their vertical position if thrown down, by growth taking place on one side of a node, is also of great importance. The amount of silica deposited in the cells of the stem doubtless also contributes to their strength.

Climbing stems have been studied chiefly in relation to light. One great advantage, which climbing plants possess over others, is, no doubt, that by this habit they are enabled to get their leaves more quickly up to the light. In a thick wood this must be of the highest importance. At the same time climbers avoid the expenditure of material necessary to form an erect, woody, self-supporting stem. The climbing habit, however, is also advantageous, as enabling a plant to contend with the wind, and may in some cases have been acquired for this reason. The large leaves of some climbers would lead us to think that the advantage of climbing was quite as great in relation to the destructive force of wind as it is in enabling the plant to gain access to the light.

If we are not yet in a position to form very

definite conclusions on some of the questions suggested, the considerations brought forward in this paper may be of service in calling attention to the importance of certain branches of natural history. The geographical distribution of species, their vertical range, their habitats and dimensions, have not hitherto received the attention they deserve. The subject is full of interest, but at every step the necessity for further observations has been apparent. New lines of investigation seem to open up on every side. We have here and there caught glimpses of the great principles by which Nature fashions her strange and manifold productions. But the external morphology, the internal anatomy, and minute structure of a living body, will be invested with a new and fascinating interest when we are able to connect each organ with its peculiar function, and when we can trace to its origin every morphological feature which it presents.

XXIV.

THOMAS HOPKIRK OF DALBETH: A Sketch of his Life and Botanical Work.

BY ROBERT TURNER.

[Read 27th January, 1885.]

THOMAS HOPKIRK of Dalbeth was in his day the most distinguished of our local botanists. He was a Fellow of the Linnean Society, a Member of the Wernerian Society of Edinburgh, and of several other kindred bodies. This serves to mark the interest which he took in science; but it suggests little of that enthusiasm which, for a great part of his life, made the study of plants a passion with him rather than a pastime, and the wonders of the vegetable world his chief delight and recreation. He was a botanist, and yet something more than a botanist—he was a devoted flower-lover. Mere collections of plants dead and dried did not satisfy him. In those old-world times before Waterloo had been fought, he gathered round his home by the Clyde plants native and alien by the thousand. His garden at Dalbeth became the nursing mother of what is now the Glasgow Royal Botanic Garden, and it is mainly owing to that zeal of his some seventy years ago that we have today anything more about Glasgow illustrative of Natural History than useful dry-as-dust museums of dead creatures, preserved or petrified.

The object of this sketch is mainly to put on record something bearing on his work, before all remembrance of him passes away; but I shall also attempt to estimate the amount of difference that has arisen in the Flora of the district since his time, and to

account for it. Though only a comparatively short period separates us from his days of enthusiastic labour among herbs and weeds, so great have been the changes in and around this ancient city that these times only seem near to us when we think of the turbulent centuries beyond. Since then Glasgow has grown into a really great city; and when we reflect on the many indispensable elements in our present civilisation that were at that time unknown, we can readily conceive why this yesterday ranges itself so distinctly with the dead past.

While many men of less desert have gathered around them far-sounding posthumous reputations, Thomas Hopkirk's work has been nearly forgotten. I trust to be able to show how much he did and how assiduously he wrought as the pioneer botanist of Clydesdale.

He was born at Dalbeth, near Glasgow, in 1785. The family of which he was a member had long occupied an honourable position in the city. His grandfather was a West India merchant—one of those so-called "Tobacco Lords" or "Virginia Dons," who during much of last century bore themselves bravely on the "plain-stanes." He was also one of the original partners of the "Glasgow Arms Bank." About the middle of the century he lived in High Street, on the east side, five doors north of the Cross, in a tenement long known as "Hopkirk's Land." In a part of this house the celebrated David Dale afterwards retailed French yarns and acted as agent for the Royal Bank of Scotland, when in a humble way its first Glasgow branch was opened there. About 1754, this Thomas Hopkirk purchased Dalbeth Estate, and there he died in 1781.*

* It might be interesting from a Glasgow standpoint to say more of this grandfather, Thomas Hopkirk, and his times, and the strange anomaly by which he was fined £20 in 1752, for declining to accept the office of Councillor to which he had been elected, and again in 1779 was forced to raise an action in the Court of Session to escape a fine of £40 imposed on him by the Town Council for refusing to accept the office of Dean of Guild.

Though the Hopkirks resided much at Dalbeth, they kept a town-house as well. In 1777 they removed to a new mansion at the east corner of Dunlop Street and Argyle Street, which was sold in 1790, and converted into the much-frequented hotel, whereof the stone Buck's-Head surmounting the present buildings is a memento. Dunlop Street was then being laid out as a fashionable quarter. Sir John Moore's father, the accomplished and impecunious doctor who wrote *Zeluco* and many other works, lived a door or two from the Hopkirks; and among other neighbours were two reverend doctors, whose righteous souls were grieved to the quick of legal redress-seeking when the foundations of a playhouse were laid in the street. It was only after a new mansion had been built at Dalbeth by James Hopkirk, the father of the botanist, that it became the permanent abode of his family.

James Hopkirk was also a man of worth and standing. He married Miss Christian Glassford of Dougalston, of the family long so intimately connected with Glasgow affairs which has left a perpetual memento in the name of Glassford Street. He lived to an advanced age, and wrote amongst other things an *Account of the Forth and Clyde Canal Navigation.* But it is with Thomas Hopkirk, the enthusiastic and assiduous observer of nature, we have to do, and so I must limit myself to these mere fringes of fact about "forebears." Both by father and mother he has the *locus standi* of a Glasgow connection going back beyond a grandfather at least.

He was educated in Glasgow, and in 1800 matriculated at the University.* The nearness of Dalbeth to the city brought him within the influence of the learning and culture of the time; while its situation,

* One of the entries in the University Album for 1800 is as follows: "Thomas Hopkirk, filius natu maximus Jacobi armigeri de Dalbeth, in Parochia de Barony in Comitatu de Lanark."

amid country sights and sounds, helped, we cannot doubt, to stimulate his early love of nature and taste for botany.

In 1813 he published his *Flora Glottiana*,—the first catalogue of the plants of the Clyde district, and indeed in this country one of the earliest local Floras. Curtis's *Flora Londinensis*, Sibthorp's *Flora Oxoniensis*, and Abbot's *Flora Bedfordiensis* were among the few works of the kind issued before his day. Sketches of several Scottish districts had appeared in larger works. In Ure's *History of Rutherglen and East Kilbride* (1793), for instance, there is a short list of the rarer plants found in that district. Hooker's *Flora Scotica* and Greville's *Flora Edinensis* were only published several years later than the *Flora Glottiana*. While Hopkirk availed himself of the valuable *Flora Scotica* of Lightfoot (1777) for reference, the still older work of Sibbald, *Scotia Illustrata* (1684), appears to have been wholly disregarded by him.

Hopkirk entitled his work, "*Flora Glottiana:* A Catalogue of the Indigenous Plants on the Banks of the River Clyde, and in the Neighbourhood of the City of Glasgow."

It was published in Glasgow by John Smith and Son, and printed by William Lang, 62 Bell Street. The preface is dated from Dalbeth, 6th September, 1813, and in it he defines the district to which his list is restricted, as "the country within a few miles on both sides of the River Clyde from its Falls above Lanark, to its junction with the sea some miles below the town of Dumbarton." He was quite aware that the district is by no means so rich botanically as many others, for he wrote as follows: "For beauty, richness, and variety of scenery, the district of Clydesdale can scarcely perhaps be equalled, and although the number of rare plants falls short of what might be expected from the variety of soil and situation, still it is sufficient to

interest the botanist, as will be perceived from an inspection of the Catalogue."

This recognition of our Western deficiency, at a time when the difference of the plant-life of the various British districts had been but little attended to, is an interesting proof of Hopkirk's botanical insight. It was evidently clear to him that soil and climate did not suffice to account fully for plant distribution in Britain. He apologises, as it were, for these beautiful and diversified landscapes being clothed in such an ordinary garniture of vegetation as compared with other localities often plainer and tamer. There is, besides, an undertone of disappointment in his remark that "the number of rare plants falls short of what might be expected from the variety of soil and situation." Where in Britain could conditions be more favourable to plant life? A district of no great extent but of almost limitless diversity, comprising rich alluvial land, light sandy tracts, stiff clays, dreary moorlands, bogs, lakes, river-flats, brackish and salt-water marshes, as well as mountain and glen, woodland and meadow, river-bank and sea-shore,—and all this multifarious divergence acted upon favourably for vegetation by prevailing moisture and a climate moderated by sea-nearness and by the stream of warmth from across the Atlantic that breaks on the shores. Why should the number of plant species be so limited and so few rarities have taken root in such a land of botanical promise? The fact he recognised, and there are even yet points in the problem it presents that have not been wrought out quite satisfactorily.

The area embraced is, you will observe, somewhat similar to that of Hennedy's *Flora of Clydesdale*, published 1865, but hardly so extensive, as the latter included the whole valley of the Clyde from the Falls to Arran, and the nearer hilly country to the north and south, as well as that about the winding shores of the lochs on the northern part of the firth. Patrick's *Flora of Lanarkshire*, 1831, has on the other

hand a more restricted area, confining itself within the boundaries of the county, and on this account it lacks all the plants of the sea-board.

Hopkirk enumerates about 675 species and varieties of Phanerogams, including 2 species of Characeæ; 32 species and varieties of Ferns; 80 Mosses; 19 Hepatics; 94 Lichens and Algæ, including 10 Fungi then classed as Algæ; and 99 Fungi.

For the sake of comparison, the following details as to other works of a similar kind may prove useful, flowering plants only being included:

Greville's *Flora Edinensis*, 1824, takes in the district within ten miles of Edinburgh, and enumerates 771 species.

Patrick's *Flora of Lanarkshire*, 1831, includes 604 species.

Hennedy's *Flora of Clydesdale*, 3rd edition 1874, gives 809 species and 109 varieties.

The list in our published *Fauna and Flora of the West of Scotland*, 1876, comprehends 748 species and 88 varieties of plants considered to be indigenous, and 126 species and 2 varieties occasionally found but not indigenous,—in all, 874 species and 90 varieties.

Lightfoot's *Flora Scotica*, 1777, gives descriptions and records localities for about 825 species.

Hooker's *Flora Scotica*, 1821, includes 1075 species.

In the last edition of the *London Catalogue of British Plants*, the total number of the species of flowering plants found in the British Islands is 1601.

Hopkirk's catalogue is arranged, I need hardly say, on the Linnæan system, and follows in the lines of Smith's *Flora Britannica*. It includes every plant *apparently* indigenous, however doubtful that may be from situation or any other circumstance.

In Class I., Order I., Monandria Monogynia, he includes the Charas, at that time and for years after classed as flowering plants. Linnæus himself at first placed this genus among the Cryptogamia; but as the organs of fructification were found to be con-

stantly of two kinds, he came, in common with the majority of the botanists of that time, to regard the one form as the stamen and the other as the pistil, and the plants themselves as phanerogamic. In accordance with this view it became usual to class them either in Monandria Monogynia or in Monœcia Monandria. Of the six species given in Smith's *Flora Britannica*, Hopkirk only records two for the district—*Chara vulgaris* and *Chara flexilis*, both of which he states to be frequent. He gives as stations—for the former, Bogle's Hole and Kenmuir, Bardowie Loch, and Cartland Crags; for the other, Bogle's Hole, Mugdock, Bardowie and Frankfield Lochs, a ditch near Port-Dundas, and abundantly in one two miles beyond Possil. The last station is perhaps the ditch at Possil Marsh, where the plant is still abundant. This marsh is usually referred to in his book as the marsh beyond Possil.

The Mare's-tail *(Hippuris vulgaris)* is the next plant to which I shall refer. For it he only gives one station, Castle-Semple Loch. Nowadays, though perhaps not to be called common, it is abundant in several localities. Possil Marsh holds a supply of it able to meet a demand much greater than is ever likely to arise. In 1813, it either did not grow there or had been overlooked by Hopkirk, a very unlikely supposition in this case. Again, Castle-Semple Loch is the only station in the district mentioned by Hooker in 1821. By the year 1831, when Patrick published his book, Possil Marsh was known as a station.

It would be interesting to be able to settle definitely how much the flora of this marsh has been affected by the formation of the Forth and Clyde Canal; but of course that can only now be guessed at. There is every reason to suppose that new plants would appear in it after the canal brought it into connection with the Eastern district.

The highest level of the canal is attained about 10¼ miles from Grangemouth, where the twentieth

lock is 156 feet above the first one. This level is maintained for 16 miles. From the twenty-first lock at Maryhill to the thirty-ninth lock in Bowling Bay, there is again a descent of 156 feet, and that in $8\frac{3}{4}$ miles. Thus for about 15 miles east of Possil there is an open canal, while about a mile to the west the locks begin. This would appear to be more favourable to the introduction into the marsh of plants from the East than from the West.

Again, the cutting of the canal was commenced in 1768 from the East side, and in 1775 it was open to a point nearer Glasgow than the marsh. In 1790 it was open to Bowling, that is, from sea to sea. We thus perceive that the marsh had an Eastern connection for many years before the Western one was completed.

We can hardly doubt that both of these circumstances, alike in favour of the introduction of plants from the Eastern district, have had some influence on the flora that now inhabits it; but as we cannot say how much the whole character of the vegetation may have been affected by the canal, so do we remain at a loss to determine the effect of these causes. It has little bearing on the subject that the vegetation of the marsh does not now show many indications of change. It has been frequently observed that a sudden alteration in conditions like this introduces new forms of vegetation for a time till comparative stability is again attained.

The Mare's-tail, for instance, had probably not reached the marsh in 1813, and certainly had not succeeded in developing there in any quantity, as it is quite inconceivable that Hopkirk or any other botanist could have overlooked so conspicuous a plant, if it had occurred in anything approaching the profusion now attained.

Circœa lutetiana he mentions as "in shady places and woods occasionally," giving a few stations. Patrick and Hennedy both record it as frequent, and when we recollect how often we have found it

in our own rambles growing luxuriantly on banks and in woods, we must admit that the latter term is the more correct one. He also gives *C. alpina* as rare, and records for Ardencaple Wood the variety *intermedia*, which neither Patrick nor Hennedy mentions, perhaps because they considered it a hybrid.

Of the genus *Veronica* he enumerates all the species mentioned by Hennedy except *V. Anagallis*, which has never as yet been recorded for the district to which Hopkirk restricted himself. One of the species of this genus, named *Veronica hirsuta* by Hopkirk, still retains a place in the British Flora, though its claim to be considered a distinct species is doubtful. He does not include it in the catalogue, as it was not found within the limits of the district defined; but he refers to it in a note. He says: "I received during last summer, from Mr. Smith, Nurseryman, near Ayr, a Veronica, which seems different from any hitherto enumerated as British. I have called it *V. hirsuta*, and describe it as follows:

"Root perennial, fibrous. Stems branched, procumbent at the base. Leaves opposite, on short channelled footstalks, ovato lanceolate, acute, oblique, dark green, the under side rugged, the edges ciliated, the upper side as well as the whole plant covered with white jointed hairs. Flowers in a long spike, not crowded, on short footstalks; floral leaves linear obtuse, not much longer than the footstalk of the flower. Petals pale blue, with a dark line running down the centre of the side petals, which are broader than the two others. The upper leaf of the petal very narrow. Tube white, stamens nearly the length of the style, both longer than the petal. Anthers violet colour. Calyx leaves four, linear, unequal. Capsule compressed, entire, not notched, tipped with the long permanent style. Plant about three inches high. Native of dry heathy places, in the district of Carrick, in Ayrshire. It agrees somewhat with *V. alpina*, but

differs in the whole plant being smaller, leaves much narrower in proportion to their length, and the whole plant being hairy, and particularly in the capsule being entire, and not notched. It flowers in June and July.

"*Veronica hirsuta.* Spec. char. Corymbus terminal. Leaves opposite, oval, entire, acute, set with hairs on the upper side and edges. Capsule compressed, not notched."

Sir William Jackson Hooker, referring to this plant in his *Flora Scotica* (1821), says: "It is not without considerable hesitation that I have published this as really distinct from *V. officinalis*." He then enumerates the characteristics of the plant that appear permanent, and adds: "The discovery of this curious little plant is due to Mr. James Smith, a very able and intelligent botanist, of the Nursery-Ground, Monkswood-Grove, Ayr." Again, in his *British Flora*, he says: "It has all the appearance of a starved plant of *V. officinalis*, and the *flowers* are very generally abortive. The *fruit* certainly differs in wanting the deep notch at the extremity; and the plant remains unaltered, in this respect, for a succession of years in cultivation."

In Hooker and Arnott's *British Flora*, and in Hooker's *Student's Flora*, it is merely given as a variety of *V. officinalis.*

Lindley seems to have considered it a distinct species, and the equivalent of *V. setigera*, Don.

Watson in his *Compendium of the Cybele Britannica* mentions it among his ambiguities, thus: "*Veronica (officinalis) hirsuta*, Hopkirk. . . . Ayrshire only, and now extinct?"

In Sowerby's *English Botany*, Dr. Boswell Syme classes it under *Veronica officinalis* as variety *b.* He says: "Var. *b.*, of which I have seen no wild specimens, is a very remarkable form, which preserves its characteristics under cultivation; but I hesitate to consider it as a sub-species, because the typical plant is liable to great variation in the very points

in which it differs from *V. hirsuta*, and it would require to be studied in its native habitat before a definite opinion could be given."

Enough has been said to show clearly that this plant of Hopkirk's was a genuine find, either a remarkable variety of *V. officinalis*, or a distinct subspecies. It was long cultivated by botanists in gardens, and was found to retain its distinctive peculiarities. For many years back it does not seem to have been reported from Ayrshire; but it is probable that a diligent search might still be rewarded with success.

Utricularia vulgaris he chronicles as growing "in a deep hole in the marsh, Possil. Also at Robroyston." Of late years its occurrence in either of these stations has not been recorded. Altered conditions may have occasioned its disappearance. *Utricularia minor* is found abundantly in Possil, but the only station Hopkirk gives is "the Loch at New Kilpatrick" (St. Germain's Loch presumably). He appends an interesting note on *U. vulgaris:* "In searching for this plant," he says, "in the beginning of April, I could find no appearance of it in the water; but upon examining the mud at the bottom of the pond, I found a number of little green balls, which, upon examination, proved to be the tops of the last year's plants, which, falling off, had lain there during the winter, and when found were just beginning to take root. By this manner it seems to propagate itself."

This is an interesting observation; and, from the way in which he speaks of it, we are led to infer that it was an original one on his part. Under any circumstances the fact which he chronicles is correct. This mode of propagation is not mentioned in several works which I have consulted, but it is in Hooker and Arnott's *British Flora*, where it is stated that "it propagates itself by buds or *gemmæ*, which proceed from the ends of the shoots, and seldom flowers." Darwin, in his *Insectivorous Plants*, says:

"In the early part of autumn the stems terminate in large buds, which fall off and lie dormant during the winter at the bottom."

He only enumerates one species of *Lemna (L. minor).* The other three now found in the district are on the whole rare, though occasionally plentiful in certain places, as is the case with *L. trisulca,* which is especially abundant in the Forth and Clyde Canal and in Possil Marsh. These native British plants may possibly have found their way into the Clyde district since his time, but as they are inconspicuous, I am of opinion that they were overlooked by him, or regarded as only constituting one species.

For the Marsh Valerian *(V. dioica)* he records Balvie as a station, and states that the plant is rare. It is still rare, but occurs in the district, though, probably owing to improved drainage and other changes, it seems to have disappeared from Balvie. *Valeriana pyrenaica* is almost certainly an alien; yet it is so well established in the West of Scotland, so frequent and in such profusion in wild spots, that it seems to take as kindly to our glens and burnsides as to its native Pyrenees. Hopkirk records several stations for it quite near the city. Though not now found in any of these places, it is abundant at greater distances. Its comparative frequency is probably attributable to the fact that it was once prized as a showy plant in cottage gardens, while its seed is exceedingly well adapted for distribution by the wind.

Fuller's Teazel *(Dipsacus fullonum)* he gives as growing in the fields near Cathcart and Langside, where of course it no longer exists; but it still occurs, not far from these localities, at Arden Quarry, Thornliebank.

He chronicles the occurrence of *Scabiosa arvensis* —now usually known as *Knautia arvensis*—as rare, giving as a station a dry sandy field near Tollcross. It still occurs in the district sporadically; and it is

very interesting to contrast its scarcity in Clydesdale with its profusion in the Forth district.

The whole of the district *Rubiaceæ* are entered in his list except *Galium uliginosum*, which is not frequent near Glasgow. *G. Mollugo* and *G. boreale* he gives as not common. The stations mentioned are those where they are still known to occur. The former is probably not indigenous in the district, while the latter is undoubtedly a native.

In connection with the Plantains, he points out that *Plantago maritima* is by no means confined to the sea-coast, quoting Ure's inland station for it, "on the roadside near to the avenue into Whitemoss." Lightfoot says of this plant: "It grows not only by the seashores, but even to the summits of the highest mountains in the highlands." This peculiarity it has along with many other plants that are usually considered inhabitants of shores. The climate of certain elevated districts is evidently favourable to their growth, as is that near the sea, and this is probably mainly owing to the moisture of the atmosphere and the plenteous rains.

Centunculus minimus is not now known to occur "in a marsh near Langside," quoted by Hopkirk on the authority of Dr. Brown, or "in Kenmuir bog." It is still found, however, somewhat beyond the boundaries of Hopkirk's district, in Cumbrae and Arran.

Epimedium alpinum—clearly an introduction—grew at that time abundantly about the ruins of the old Castle of Mugdock.

For Wall Pellitory *(Parietaria officinalis)*, he gives two stations—one on the authority of Ure, "on an old wall on the roadside between Rutherglen and Farme;" and the other "on the ruins of Bothwell Castle abundantly." At the latter station it still holds its own; and this is now, I believe, the only place in Clydesdale where the plant can have any claim to be considered indigenous. When we reflect, however, on the number of plants that are found on

these ruins and in the surrounding grounds that have beyond question been introduced, the doubt remains whether this is not also strictly a stranger that has been induced to settle there.

A smaller variety of *Alchemilla vulgaris* he records as occurring on the Cathkin Hills, having more pubescent and silky leaves than the ordinary form. This he terms variety *minor*. It is probably the variety now usually designated *montana*, the *Alchemilla montana*, Willd.

Sagina apetala, which he gives as common, is presumably an erroneous entry, as there is every reason to suppose that it did not then occur in the Clyde district any more than now. Hennedy says "the *Sagina apetala*, described in the district by *Hopk.* and *Patr.* is *S. subulata*." This may be correct, but in the case of Hopkirk, from his mentioning the plant as common, it appears to be uncertain whether it was not rather some form of *S. procumbens* that he meant. Under any circumstance, *S. subulata*, Wimmer, had not been in his time, and was not for many years after, recognised as a British plant.

Allseed *(Radiola millegrana)* is stated to grow "about Langside," on the authority of Dr. Brown, and Hopkirk himself appears to have found it plentifully on the roadside between Dumbarton and Helensburgh. Hennedy found it in Possil Marsh in a cutting, and it is frequent near the coast, but readily overlooked from its inconspicuousness.

His list of the species of *Potamogeton* virtually agrees with those we still recognise in the district. His *P. fluitans* is now usually known as *rufescens*. His *P. compressum* is probably the variety *compressus* of the species *pusillus*. *P. oblongus* was then included in *P. natans*, of which it seems at most only a subspecies. There is thus really no difference between his list and that of Hennedy, so far as these plants go. He mentions, however, a variety of *lucens* as occurring in Bardowie Loch ("folio angusto, pellucido, ferè gramineo"). No variety of *lucens* is referred to

by Hennedy; and since the pondweeds have become more accurately determined, it would be interesting to know whether any peculiar variety or allied species occurs in this loch. Three British pondweeds closely allied to *lucens*, viz.: *P. decipiens*, Nolte, *P. Zizii*, M. and K., and *P. nitens*, Weber (which is found in Loch Ascog, Bute), have never yet been recorded for the district of the *Flora Glottiana*. Bardowie Loch appears to have been little visited of late years by botanists, and might repay research.

At the time when this *Flora* was published, only two species of *Myosotis—scorpioides* and *palustris*—were generally recognised by botanists, and the latter had but recently been raised to specific rank. The different varieties he mentions seem, however, to represent all the species yet known in the district. By *M. scorpioides*, var. *b.*, he appears to mean *M. versicolor*, Reich. *M. repens* and *cæspitosa* were still generally confounded with *M. palustris;* but in a note referring to that plant, he says: "There is still a perennial variety that does not seem to have been noticed by authors. The whole plant is small and remarkably hairy; in other respects it agrees with *M. palustris*." This appears to be *M. repens*, Don; and if so, Hopkirk has recognised its distinctness, although it is not so distinguished in the *Flora Britannica* of that date. It was, however, first fully described by Don.

The Evergreen Alkanet *(Anchusa sempervirens)* he records for the neighbourhood of Hamilton; and most of you are aware that it is still abundant "near Chatelherault," one of his stations. Of course, there can be little doubt that it was originally introduced.

He also recognises the variety *patens* of *Symphytum officinale*, first described by Sibthorp. For *Symphytum officinale* proper, he gives, "Banks of the Clyde, but not very common." The variety *patens* he states to be very common on the banks of the Cart about Cathcart and Langside, and it is still so. He adds: "Plant larger and rougher than *S. officinale*. Calyx

expanded, petals very much inflated, red." Though Hennedy does not specially distinguish it, it is, I think, by far the commoner form in the Clydesdale district, if not indeed in Scotland, and differs markedly from the ordinary *officinalis*.

The tuberous Comfrey *(Symphytum tuberosum)* is recorded as "common,"—a correct term locally for this somewhat rare British plant.

Echium vulgare occurred only very occasionally then as now, and he adds significantly "generally near houses or gardens."

The Cowslip *(Primula veris)* he mentions as growing about Bothwell and Woodhall, but introduced. In a note he adds that "it is not to be found indigenous in the neighbourhood of Glasgow." Strange as it may seem that such a common English flower is not properly to be classed as belonging to our district, the fact remains, and affords another instance of the vagaries in the geographical distribution of plants. He also states that "from recent experiments made at Dalbeth there seems no reason to doubt that the *Primula elatior* is a hybrid between the *vulgaris* and *veris*." This observation is correct, if by *P. elatior* is meant the Common Oxlip, as was no doubt the case; but there is a *P. elatior*, Jacq., the Bardfield Oxlip, which, though it closely resembles the hybrid, is a true species. Darwin enters fully into this subject in chapter ii. of his *Different Forms of Flowers*.

Lysimachia vulgaris occurred then as now occasionally in the district. It is still found on "Kenmuir banks," one of his stations.

He records *Lysimachia thyrsiflora*, on the authority of the *Flora Britannica*, as occurring "on the edge of a lake to the north of Glasgow;" but adds in a note: "I have very often sought for this plant on the edges of all the lakes near Glasgow without success." Here we may pleasantly reflect that Hopkirk did not quite know everything about the plants of the district. I think there can be little

doubt that the lake meant is Possil Marsh, which lies to the north of Glasgow, and along the edge of which the Tufted Loosestrife still abounds. It does not appear to occur in any of the waters properly called lakes near Glasgow. It was probably introduced into Possil Marsh through the medium of the canal, in which it is profuse. Though a large plant, it does not readily catch the eye, owing to its semi-aquatic mode of growth; and it was then probably very rare in the marsh, instead of being common as it is now.

Anagallis cærulea, the Blue Pimpernel, he gives as "said to grow in the fields about Lanark;" and his opinion seems to be that it is a separate species rather than a variety of *A. arvensis*.

Convolvulus arvensis he inserts, adding "but not common," a statement which still applies. *C. sepium* was "frequent" in 1813 in cultivated fields and hedges, just as it was last summer.

The rare *Lobelia Dortmanna* opened its blue blooms in all their native beauty in Bardowie and Mugdock Lochs then as now.

The introduced *Impatiens Noli-me-tangere* probably still grows "abundantly in a wet glen at Castlemilk;" but near as that is to the city—perhaps because near—it seems to have become a *terra incognita* to all outsiders save poachers, so that Touch-me-not is quite an appropriate denizen of the place.

The Violets enumerated are the same as those of to-day; but the *Viola canina* of the books of that time was a segregate species, including *sylvatica* and *flavicornis*. The variety *arvensis* of *V. tricolor* is not distinguished by him. The Sweet Violet *(V. odorata)* still nestles here and there on dry bank or at hedge foot as then; but it cannot be considered indigenous.

Neither can we regard as native in his district such plants as *Verbascum Thapsus*, *V. Lychnitis*, *Hyoscyamus niger*, *Atropa Belladonna*, *Vinca minor*, and *V. major*, which he records, and which we fall in with occasionally near gardens, in old quarries,

on rubbish heaps and similar places. The first of these, however, is probably indigenous quite near to the limits of the district.

He refers to a form of Honeysuckle with notched leaves, "somewhat like those of the oak," as occurring in a small wood near Calderbridge.

Flax was then grown in the neighbourhood, for he states that *Cuscuta Epithymum* was found on its stalks about Hamilton and Woodhall. Very rarely now is a crop of lint to be seen in the bell in any part of Clydesdale, and the parasite has passed away with the plant on which it preyed. The species that occurs on Flax is now known as *C. Epilinum.*

For *Meum Athamanticum* he gives several stations, including two in Kilbride on the authority of Ure. The district about Newton Mearns, where it is now of most frequent occurrence in this neighbourhood, he does not mention. As the root appears to have been made use of at one time as an aromatic and carminative, the frequency of the plant in certain localities may be the result of former cultivation.

His *Sium verticillatum* is what we now know as *Carum verticillatum*, a very characteristic West-country plant. He observes that it "is not confined to salt marshes and meadows near the sea; it is very abundant in the neighbourhood of Luss, ten miles from the coast." Lightfoot describes it in the *Flora Scotica* under the name of *Sison verticillatum*, and an excellent figure of the plant is given. He states that it is common in many places on the western side of the kingdom. For this district he gives: "In moist meadows about Greenock plentifully, first observed by Mr. Houstoun."

The plant recorded by Hopkirk under the name of *Œnanthe pimpinelloides* appears to be *Œ. Lachenalii*. *Œ. crocata* is set down as frequent, and *Œ. fistulosa* as rare. It is doubtful whether the latter is now found hereabouts at all.

Scandix Pecten-Veneris, Venus'-Comb, he states to be common in cultivated fields. It is not now com-

mon or even frequent, but exceedingly rare. Further, Patrick avers that it is common in cornfields, and adds, after the names of two farms near Hamilton, the broad-spirited word *etc.*, which seems to signify something like a wave of the hand all round the horizon. By Hennedy's time it had become rare, as it still is. In Clydesdale it is now in fact almost unknown. The rise and decline of a weed may seem a trifling matter to those who can only appreciate large effects, monstrous births and deaths of time. Weeds are, however, more enduring than empires, and as old as agriculture itself. They often mark civilisation more surely than the gibbet once did. It is probable that the seeds of *Scandix* were then sown regularly with certain crops, and that though in this way the species appeared commonly in our fields it had never truly taken hold; and that when this human agency was withdrawn, owing to corn more thoroughly winnowed coming into use, it gradually decreased in number and finally disappeared, the climate and soil being unfavourable to its spontaneous reproduction. Several other cornfield weeds, to which I shall refer, afford additional instances of disappearance apparently due to similar causes.

For *Sambucus Ebulus* he quotes Ure's station—"on the roadside between Kittochside and Carmunnock"—where the plant still grows. In the other stations which he gives I am not aware that the plant now occurs.

He has an interesting note on the Barberry. "The stamens of the Barberry," he writes, "when touched at the base of the filament, contract suddenly, and throw the pollen against the stigma; it is worthy of remark, however, that if the petals are cut off, though without injuring the other parts, the stamens instantly lose their irritability, and are no longer affected by the touch of any extraneous substance." With reference to the pollen being dusted over the stigma in this way, Hermann Müller (*Die Befruchtigung der Blumen durch Insekten*," 1873) has shown

that the irritability of the stamens of Berberis is a contrivance for cross-fertilisation rather than for self-fertilisation.

Of the *Polygonaceæ*, he enumerates all the Docks that are found in the district, except the following two, which are very rare and probably not native. *Rumex Hydrolapathum* has perhaps been introduced both at Woodhall and Corehouse; and *R. pulcher*, given in our lists on the authority of Patrick as found "between Barncluith and Hamilton Wood," no longer grows there, and is undoubtedly not native in this part of Britain. Of the genus *Polygonum* he gives all the recorded species about Glasgow, except *P. minus*, which is retained on our lists as occurring on the gravelly banks of the Black Loch. There is a Polygonum common on these banks—a peculiar stunted form of *P. Hydropiper* which has perhaps been mistaken for *P. minus*.

Alisma ranunculoides, given as "rare," is stated to occur "in the marsh beyond Possil." It has quite disappeared from that station, but is still found abundantly in moist places in the Clyde islands.

All the species of *Epilobium* and *Erica* found here are given. *Andromeda polifolia* had not then been discovered in the neighbourhood. It appears, however, to be undoubtedly native, and probably occurs more frequently than is supposed, as it is not very easily seen, owing to its prostrate habit and the situations in which it grows.

For the Herb Paris *(Paris quadrifolia)*, he gives two stations: "Banks a little above Calderwood, Ure. Banks of the Cart opposite the mill, Dr. Brown." Hennedy considers this plant "a doubtful native"; but it grows in wild places here and there about Clydesdale, and there is nothing to indicate that it has been introduced. Though it may be called rare in the West of Scotland as a whole, it usually grows abundantly in the stations where it is found. It is in no sense a weed, but an inhabitant of woods. On these grounds I think there can be

little question that it is truly native. The next plant in Hopkirk's list is the pretty little *Adoxa Moschatellina*, which everyone recognises as indigenous. Yet it shows some inclination towards cultivated spots. This difference of habitat between these two plants, though so slight, is well brought out in the *Flora Glottiana*, where *Paris* is said to grow "in woods," and *Adoxa* "in woods and at the roots of hedges." Though *Adoxa* is much commoner than *Paris*, it is not so distinctly a dweller in the wild woods. The rarity of *Paris* may perhaps arise from its being a forest plant that has survived till suitable wild places for it to flourish in have become scarce.

On the authority of Lightfoot, he quotes *Pyrola rotundifolia* as growing at the Falls of Clyde; but he adds a note to explain that he regards this as an error. The plant which Lightfoot meant he identifies as *Pyrola media*, but it is undoubtedly *Pyrola minor*. Long after the days of Lightfoot and Hopkirk alike, both *rotundifolia* and *minor* have been confused with *media*.

Of the Saxifrages, he only gives *Saxifraga stellaris*, *S. granulata*, and the introduced *S. umbrosa*. The others we know of are certainly very rare in the district; but *S. oppositifolia* occurs at Corra Linn, *S. hypnoides* about Campsie, Dumbarton, &c., and *S. aizoides* in various localities in the hilly country around. He also records both species of *Chrysosplenium*, giving as stations for *C. alternifolium*, which is much the rarer of the two, "in the glen, Castlemilk," and "Beetle's Burn, near Clyde Iron Works."

Scleranthus annuus is given as plentiful on the sandhills, Tollcross, where it is still found.

He appears to have been the first botanist who recognised the very distinct variety *hirsuta* of *Silene inflata*. He says: "In this variety, which does not seem to have been previously remarked, the leaves are much narrower, and the whole plant thickly set with glandular, white, simple hairs." This variety is still to be found at the Old Waterworks quite near

the station which he gives, "at the ferry, Clyde Iron Works."

He enumerates all the species of *Stellaria* and *Arenaria* included in our lists of to-day, and all those of *Sedum* given for his district. He records, besides, the introduced *Sedum reflexum* as found on the ruins of Craignethan Castle.

He calls attention to a variety of *Oxalis acetosella*, frequent in woods, with large purple flowers. The introduced *Oxalis corniculata* he mentions as found on an old wall between the Avon and Barncluith. Of this plant, Patrick says: "Found as a weed clinging to the roots of other plants about Barncluith and Claud's Burn."

I have again to note a weed in cornfields which we now see very rarely in Clydesdale, and which Hennedy calls "not common,"—*Agrostemma Githago*. Hopkirk says, "among corn, frequent." Patrick says, "common among wheat." Its infrequency nowadays I believe to be due to the same causes that I have already referred to in the case of *Scandix Pecten-Veneris*.

Agrimony *(Agrimonia Eupatorium)* appears also to have been commoner then. He says, "in hedges, and on the borders of fields, common." That is hardly the case now within his limits. Hennedy, with reference to the district embraced by his *Flora*, in which there is so much coast-country where the plant is found in some quantity, only ventures to call it "frequent." The plant had a great reputation in rustic medicine as a cure for jaundice, diabetes, &c. On this account it was much sought after, which probably effected its extirpation in most of its native stations. Further, borders of fields are in the West of Scotland seldom left without a crop. Lastly, it seems to have been cultivated for its medicinal virtues; and as belief in its efficacy passed away, and it ceased to be grown, it would tend to disappear from waste places. It is certainly now very rare in the neighbourhood of Glasgow.

The next plant on his list to which I shall refer is one that suggests the thick coatings of thatch, which then gave kindly roofs to the villages and farms about Glasgow. *Sempervivum tectorum* is nowadays a very rare plant with us, but in 1813 it was found "on housetops frequent." I need hardly say that the cause in this case is that thatch-roofs have nearly become things of the past.

With the exception of *Rubus* and *Rosa*, nearly all the *Rosaceæ* of Clydesdale are to be found in his list. Among others, he records the introduced *Spiræa salicifolia* as occurring "at Cartland Crags, seemingly indigenous"; and the hybrid *Geum intermedium*, of which he says: "except the colour of the petals, and the smaller size of the plant, there seems no specific difference between this and the *rivale*." He has a simple and easy method of dealing with *Rosa* and *Rubus*, which was indeed the good old way in the botany of these days. Of *Rosa* he recognises only three species—*arvensis*, *rubiginosa*, and *canina*. Similarly, *Rubus* only includes *idæus* (the raspberry), *corylifolius*, *fruticosus*, *saxatilis*, and *Chamæmorus*. The simplicity of this makes one regret the enforced complexity of more recent times.

Glaucium luteum was then plentiful on the shore at Helensburgh, where it does not now make its appearance at all. It is, however, a very erratic plant, appearing and disappearing in a somewhat unaccountable manner, without much regard to the stations botanists may have assigned to it.

As to the Poppies, his entries are at first sight somewhat inexplicable. *Papaver dubium*, the Long smooth-headed Poppy, he gives as "in sandy fields occasionally." That is not now an uncommon plant with us. *Papaver Rhœas*, the Corn Rose, is stated "to occur amongst corn frequent." Patrick, too, states that it is frequent in cornfields. Here, as in the instances mentioned before, we appear to have a weed that has forsaken us. I cannot account for the Corn Rose having become so rare, except by

assuming, as I have done in other cases, that with seed-corn thoroughly winnowed, poppy seeds are seldom sown, and that in our unfavourable soil it had never become properly naturalised. With the hand of the sower no longer scattering abroad its seeds unintentionally, it has ceased to bloom. *Papaver dubium* is not now perhaps more abundant than in 1813, but as the other has virtually withdrawn from competition, it takes our attention more.

The yellow Water-Lily and the white one were alike frequent in our lochs; but *Nuphar pumila* was not then known to occur in the district, and was first discovered by Mr. George Gardiner in some of the small lochs round Glasgow many years later. In a note, however, Hopkirk says: "A new British species has been lately discovered by M. Borrer in the lake on Ben Cruachan, and published in *English Botany* under the name *Nuphar minima*." This is the plant we now know as *Nuphar pumila*.

Helianthemum vulgare, the Rock Rose, is still uncommon in the district; but is found in dry pastures and banks occasionally, as in Hopkirk's time.

Thalictrum flavum is the only species of Meadow-Rue that grows near Glasgow. He records it for "the banks of the Clyde at Dalbeth and Bowling Bay." It still grows at no great distance from Dalbeth, and at a recent meeting of the Society a station near Bowling was reported.

Of *Ranunculus* all the species yet recorded appear to have then been found in the district except *R. Lingua*. This conspicuous plant, though rare in Clydesdale generally, is now abundant in Possil Marsh. I can hardly conceive that Hopkirk could have omitted it had it then grown in the marsh, especially as he had it in his garden at Dalbeth at the time when he published his *Flora Glottiana*. I think we must assume that it has been introduced there through the medium of the canal, and this opinion is strengthened by what Patrick says of it in 1831: "By the bank of the great canal near

Stockenfield." Even then, though thus found in the canal near the marsh, Patrick says nothing of its occurrence in the latter station. The presumption is clear that it subsequently found its way into the marsh; and I may add that this is besides the only station for the plant in Hennedy's *Clydesdale Flora*.

Of *Ranunculus Flammula* he states that variety *Ranunculus reptans*, Lightfoot, grows on the edge of the loch at Dougalston. This is most likely the variety we now know as *pseudo-reptans*, and not the plant generally recognised as the species *reptans*, which occurs at Loch Leven.

Ranunculus auricomus was then found occasionally as now, Kenmuir banks being its Glasgow station. This appears to be about its most northern limit in the West of Scotland; and the specimens found have usually imperfect petals, a form sometimes known as variety *depauperatus*, which apparently marks the margin of its area of growth.

Ranunculus sceleratus had a distribution very similar to what it has now, only occurring occasionally.

For *Ranunculus hirsutus* he gives a station, "side of a burn between Dalbeth and Tollcross."

Ranunculus arvensis, Hunger-Weed, was rare, but found amongst corn as "at Bogle's Hole." This troublesome weed—a pest in some parts of England—seems never to have had much hold here, and has now disappeared entirely.

Ranunculus hederaceus is one of the plants in the list, and *R. Lenormandi* is probably the one he refers to in a note as "approaching in appearance to the *R. hederaceus*."

Of course, the Water Crowfoots or Batrachian Ranunculi were not then subdivided as they are now. Though twenty or thirty British species are sometimes described in this section, they are all perhaps merely forms of one or two. Hopkirk gives *Ranunculus aquatilis* and two varieties. The one with "leaves finely divided, segments linear short, outline round," is probably variety *peltatus* of Fries;

and the other with "leaves hairlike, very long,' *Ranunculus fluitans*, Lam.

The Lucken Gowan *(Trollius europœus)* grew then, as it does yet, here and there over the district in damp pastures and on the banks of rivers. It is still to be found in all Hopkirk's stations, and the one, "Banks of the Clyde at Kenmuir," is well known to every Glasgow student of Botany.

Cat-mint *(Nepeta Cataria)* is included in Hennedy's *Flora*, on the sole authority of Hopkirk, as occurring at Craignethan Castle. We find Hopkirk himself, however, very uncertain as to the claims of the plant to rank as even naturalised. He adds a note: "Inserted on the authority of a person who sent plants from thence, not having found it myself." This is an authority of little value. Patrick gives us a better assurance. He says: "I have *seen* a few plants by the border of a field at Craignethan." This makes us certain that the plant did grow there in a somewhat uncultivated state; but that it was more than the remains of an old garden plot that he saw, or a place where garden rubbish had been put, is doubtful. It was cultivated about cottages on account of its aromatic smell, somewhat like mint or pennyroyal, and called Cat-mint because cats were fond of it. There was a popular rhyme which indirectly shows that it was much cultivated:

> "If you set it, the cats will eat it;
> If you sow it, the cats don't know it."

He records the Ground Ivy *(Nepeta Glechoma)*, and the only three mints that have really any claim to be considered indigenous in Clydesdale—*Mentha hirsuta* (now usually known as *aquatica*), *M. rubra (M. sativa)*, and *M. arvensis*.

The only species of *Lamium* now recognised as belonging to Clydesdale which he does not mention is *L. intermedium*, Fries, which had not then been recognised as distinct.

The two weeds of cultivated fields, *Galeopsis Tetrahit* and *G. versicolor*, appear to have been quite

as common then as now, though Hopkirk applies the somewhat limited term "frequent" to each. *G. Tetrahit* is classed as a "native or colonist," and *G. versicolor* as a "colonist," by Hewett C. Watson; but I am doubtful whether *versicolor* has not quite as good a claim to be considered truly native as the other. It is equally common in this district, and, as Watson himself observes, is "perhaps truly a boreal variety of *Tetrahit*." It is interesting to note that these weeds have not lost their hold since Hopkirk's time, as so many others have done. It is quite clear that they are not dependent on human sowing like Venus' Comb, the Corn Rose, and some others.

The three Woundworts *(Stachys)* had the same distribution as at present.

Black-Horehound *(Ballota nigra)*, which seems to have disappeared from the neighbourhood of Glasgow, was then sometimes found on waste ground, and Hopkirk gives as a station, "about Cathcart Castle." It was probably grown a good deal owing to its reputation in rustic medicine.

Motherwort *(Leonurus Cardiaca)* was merely a casual then as now.

Calamintha Clinopodium was only occasionally met with. It is found in truly wild places, and is undoubtedly a native, though by no means common.

Origanum vulgare (Marjoram) he gives as "in bushy places and at hedge bottoms frequent." It is now rarely met with, and this is probably accounted for by its having been supplanted in cottage gardens by more brilliant and odoriferous plants.

Besides the typical Wild Thyme he gives three varieties, two of which—the one with white flowers, and the hirsute one—we now consider mere forms. The other—"*flore amplo*"—is perhaps the variety *chamœdrys*.

For the rare *Bartsia viscosa*, so distinctly a western plant, he records two stations: "Banks of the Clyde at Ardoch Cottage. Abundantly behind the inn,

Ardencaple." In both of these stations the plant is, I believe, still to be found.

The Common Skullcap *(Scutellaria galericulata)* is unknown or almost so until we approach the margin of Hopkirk's district. His only station for it is "banks of the Clyde at Bowling Bay, plentifully." For the Lesser Skullcap *(Scutellaria minor)* only the Rutherglen station of Ure—"Banks of the Clyde at Rosebank"—is given. A railway has passed over the spot, and the plant is no longer to be found. It occurs, however, in Bute.

Linaria Cymbalaria grew then, as it does still, "on the old walls, Bothwell Castle." *Linaria minor* was rare, but occurred in sandy fields and "on the old walls, Barncluith." *Antirrhinum majus* was found "on the old walls, Mugdock Castle." The first of these plants has become somewhat frequent in the Clyde district, growing on rocks by the seashore and elsewhere in what might be considered truly wild places, and is now without doubt thoroughly established—what botanists call "naturalised." The second is a very rare plant in the district, and is always connected with fields that man cultivates, or walls that he has raised. The other, the Snapdragon, is not uncommon in cottage gardens.

Scrophularia aquatica he gives as growing in a ditch in Carmyle Wood. Patrick also records the same station. Hennedy does not, and I am not aware that any Glasgow botanist knows of its existence at the present time in that locality.

His species of *Cruciferæ* are thirty-one in number, and appear to include all the indigenous plants of this order found in the district, besides a few others which have most likely been introduced. Among the latter are *Thlaspi arvense*, *Cochlearia Armoracia (Armoracia rusticana*, Bab. Man.), *Iberis amara*, *Sisymbrium amphibium (Nasturtium amphibium*, Brown), *Hesperis inodora*, *Turritis glabra*, *Brassica Napus*, *B. Rapa*, *Sinapis alba*, *S. nigra*, and *Cheiranthus fruticulosus*.

According to Hennedy's *Flora*, *Cochlearia anglica*, Linn., is frequent about Bowling, Dumbarton, &c. I am doubtful whether this species really occurs anywhere in the Clyde district. There is a large form of *Cochlearia officinalis* found in the localities cited by Hennedy; but I have failed to find any specimens that agree with *anglica* as figured and described, or with plants I have received from English stations. This is the only Crucifer given as indigenous by Hennedy, and occurring within the limits of Hopkirk's district, not recorded in the *Flora Glottiana*.

His variety *grœnlandica*, of *Cochlearia officinalis*, is most probably *danica*. *Thlaspi arvense* was then very rare hereabouts, and it still is so. Its plentifulness in some parts of the East country contrasts very markedly with its almost entire absence from our Western cornfields. Both *Lepidium campestre* and *L. Smithii* are recognised by him under the names *Thlaspi campestre* and *Thlaspi hirsutum*.

Cardamine impatiens is still found "on rocks on the banks of the river above the Falls of Clyde." Though very rare in the district, it seems to be a native.

In a note to *Cardamine pratensis*, he says: "The leaves fall off and take root in the earth, by which singular mode it very frequently propagates itself."

Sisymbrium amphibium (now usually known by the generic name of *Nasturtium* or *Armoracia*) he states to occur occasionally, and gives several stations. Hooker describes this plant in his *Flora Scotica*, quoting the same stations for the Glasgow district. The localities mentioned are: "Banks of the Clyde, frequent. In the marsh beyond Possil. In Bardowie Loch, near the house." Patrick also records this plant; but Possil Marsh is dropped from the list of stations, and he says nothing about its being frequent. He states: "Banks of the Clyde at Bogs. Bardowie Loch, near the house." Hennedy says: "I have never been enabled to find this plant in any of these stations, nor in the district." It does not now

appear to occur anywhere in the south-west of Scotland. Though at one time reported from Dumfriesshire, it would appear that it is not now known there, as it has no place in the *List of Flowering Plants of Dumfriesshire and Kirkcudbrightshire* published in 1882. The plant had probably been introduced into the district before 1813—how, of course, it is difficult to say—and never having become thoroughly naturalised, it has now disappeared. *Armoracia rusticana* occurs occasionally about Glasgow as a relic of cultivation, but it certainly could never have been mistaken for this plant by botanists. As already mentioned, Hopkirk gives this cultivated Horse-Radish under the name of *Cochlearia Armoracia*, and he places an asterisk after the name to signify that it was probably introduced, and adds, "in waste ground near gardens, occasionally."

Arabis hirsuta, under the generic name of *Turritis*, is recorded as growing "on the rocks at the bottom of the Cartland Crags plentifully." It is still found there.

Iberis amara was entered by Lightfoot among the doubtful natives, as "reported to grow in the fields between Hamilton and Glasgow." Hopkirk assures us in a note that "this plant is no longer to be found in the situation mentioned above."

Iberis nudicaulis (*Teesdalia nudicaulis*, Brown) grew then "in the sandy fields near Tollcross, abundantly." "When cultivated in the garden," he adds, "or even when sown in a moist soil, this plant increases in size, and has generally two or three leaves on the stem." It is still found at Tollcross.

The walls of Bothwell Castle were then gay in season with wallflower, as they are in our own time, while Queen's Gilliflower grew in the fields about Holytown.

He records the whole of the *Geraniaceæ* still known to occur in the district. *Erodium cicutarium* grew at Tollcross, *Geranium phæum* at Blantyre

Priory, and *G. lucidum* at Cartland Crags and near Bowling; and in all these stations they are still to be found. We retain *Geranium pusillum* in our lists on his authority. He gives it as "frequent about Cambuslang." It may then have occurred there on waste ground; but as it does not now appear to grow at all in the district, it is highly probable that Hopkirk mistook for it some form of *Geranium molle*. Under any circumstance, it has no claim to rank as indigenous.

All the *Malvaceæ* of the district are given by him. *Althæa officinalis* he states to be "rare," adding, "in a marshy place, Campsie Hills." Hennedy calls it "very rare," giving Arran and Campsie as stations. It is very doubtful, however, whether it is native at all in our neighbourhood.

The Common Fumitory and the Rampant Fumitory were pretty weeds then as now. *Corydalis claviculata* he records as "said to grow on the thatch of houses near Northpark." Though this plant is most abundant in Highland districts, covering cottage roofs and making a tangle in bushy places, as about Loch Lomond and in Bute and Arran, it is also found nearer Glasgow, as in the woods at Craigton and elsewhere; so that it is very likely it did grow then on thatch as stated.

Of the *Leguminosæ* all our species seem to be included, with the following exceptions: *Trifolium medium* and *Lotus major* are omitted, as they are also by Patrick. *Trifolium medium* is not now a very common plant about Glasgow, and, though a native of Britain, was probably still rarer in Hopkirk's time. *Lotus major* was most likely not considered a distinct species from *corniculatus*, with which, indeed, Bentham joins it. Much confusion has prevailed among botanists with reference to *Trifolium agrarium*, *T. procumbens*, *T. filiforme*, and *T. minus*, and this is reflected in Hopkirk's list. I do not profess to say what species he actually means by *Trifolium procumbens*, *T. filiforme*, and *T. minus*;

but there do not appear to be more than two of these species now found in the district—*Trifolium procumbens* of Linn. Herb. and *T. minus* of Smith.

Of the genus *Hypericum*, without reference to plants apparently introduced, none of the species of his restricted district is omitted, and indeed for the West of Scotland there are only two kinds awanting, viz., *H. Androsæmum* and *H. elodes*, which occur along the coast.

In the large and somewhat difficult order of the *Compositæ* he enumerates sixty-six of the species we now recognise; and of these three only—*Picris hieracioides*, *Hieracium prenanthoides*, and *H. pulmonarium*, which do not occur in the district—appear to have been included from errors in determination. When we consider how unsatisfactory the description of such plants often was at that time, I think we must admit the great accuracy of his work. Since his list was published only five additional species seem to have been recorded for the district, viz., *Hieracium gothicum*, Fries, *H. umbellatum*, Linn., *Gnaphalium sylvaticum*, Linn., *Senecio tenuifolius*, Jacq., and *Anthemis arvensis*, Linn. The two species of *Hieracium* are rare, and were no doubt overlooked or referred to other species. *Gnaphalium sylvaticum* is an obvious omission. *Senecio tenuifolius* is recorded in Hooker's *British Flora* for Woodhall, near Airdrie, on the authority of Dr. Graham, and this station is still retained in our lists; but the plant is most probably not indigenous. *Anthemis arvensis* is merely a casual, and of very rare occurrence.

By the banks of the Clyde about the Ironworks, *Tragopogon pratensis* shut its flowers on the summer mornings of 1813 after the dews lifted, and it still does so. The purple kind *(T. porrifolius)* was also found in apparently wild places, but it was very rare. It was formerly much cultivated, and is still found as a garden-escape.

He makes *Sonchus asper* a kind of sub-species of

S. oleraceus, giving two varieties of it—*laciniatus* and *non-laciniatus*.

Of *Leontodon Taraxacum* he mentions a variety with narrow, very deeply laciniated leaves. He gives *L. palustre* as a species, "on wet moors, not uncommon," which still remains true of it for habitat.

Cichorium Intybus, Succory, grew on the borders of fields, but was very rare. It is found casually as an escape from cultivation.

For *Serratula tinctoria*, Saw-wort, his only station is "Banks of the Clyde between Daldowie and Bothwell." This plant is undoubtedly an introduction, and I am not aware of its having been observed of recent years in any part of Clydesdale.

The Welted Thistle *(Carduus acanthoides)*, though somewhat uncommon in the district, is abundant at the present day in the immediate vicinity of the city. What a glimpse of the diminutive Glasgow of 1813 is afforded by Hopkirk's station for this plant—"abundantly in the waste ground beside St. George's Church!" Why, that is the very heart of the city nowadays; and botanists have to go much further afield for thistle-treasure.

Carduus Marianus, the Milk Thistle, is of course a garden-escape, found occasionally on rubbish and near houses, just as in Hopkirk's time. He gives as a station "on the rocks, Dumbarton Castle."

Carduus tenuiflorus grew about Balvie, where many introduced plants seem to have been found—a circumstance to which I shall have again to refer. This thistle is not known to occur now in any part of Hopkirk's district, and had most likely been introduced at Balvie. It may, however, be native about Largs, where Hennedy states that it is found.

The Melancholy Thistle *(Carduus heterophyllus)* is entered in the list on the authority of Dr. Brown as found at Daldowie. It is not now known to occur there; and from the fact that Hopkirk quotes Dr. Brown, he had probably not found it there himself. Though it usually grows in hilly districts,

there is every probability that Dr. Brown did really find this plant at Daldowie. I have observed it, along with *Galium boreale*, in wild places by the banks of streams that flow into the Avon, and there it is undoubtedly native. As these localities are in the hilly district drained by the Clyde, and at no great distance from Daldowie, there is every likelihood that it formerly grew in that nearer station. This receives support from the occurrence of *Galium boreale* about Carmyle and elsewhere in that neighbourhood.

He records the two species of *Bidens—tripartita* and *cernua*—for the district. The former he states to be frequent, and the latter rare. Neither of them now appears to be frequently met with in the vicinity of Glasgow, though both are indigenous. Perhaps the extension of the system of agricultural drainage, by curtailing the area of wet ground and reducing the number of stagnant pools and open ditches, may have rendered Clydesdale less suitable for the growth of these marsh plants.

Tansy *(Tanacetum vulgare)* seems to have been then much commoner than now. It has probably become rarer, owing to its cultivation in gardens having been almost entirely given up.

Hemp-Agrimony *(Eupatorium cannabinum)* appears to be found near Glasgow in only one station as at that time, though so frequent in its occurrence along the coast.

Mugwort *(Artemisia vulgaris)* is still frequent in hedges and waste ground.

Of the Cudweeds, *Filago minima* was then found plentifully on the Tollcross sandhills, and *F. germanica* appears to have been observed occasionally, as in the gravel-pits at Bothwell.

For *Senecio viscosus* he merely quotes Ure's station, "at Rawhead," and he speaks of it as rare. Neither does Patrick seem to have been acquainted with any other station. Hennedy gives two additional localities for it; but calls it "not common." This

weed appears to be steadily gaining ground in the vicinity of the city, as it is now to be found in a good many places. It is certainly not uncommon.

Senecio saracenicus still grows in abundance in the station which Hopkirk quotes on the authority of Dr. Brown: "In a small island in the Clyde, a little below Bothwell Bridge." We would now, however, scarcely call the place an island, though it is almost one. The plant appears to be thoroughly naturalised in the district, occurring in several stations. It was probably originally introduced on account of its reputation as a valuable styptic.

Achillea tomentosa seems to have been regarded by Hopkirk as a rare native plant. He gives as a station for it, "Spittle Hill, to the north-west of Balvie." He adds a note: "This plant, new to Britain, was discovered some time since by the gardener at Balvie, in the situation mentioned above, and since, it has been found on the hills in the neighbourhood of Paisley. . . . Since writing the above, this plant has been figured in Eng. Bot. from specimens sent from this, and more recently from Ireland." This Woolly Yellow-Yarrow is not indigenous, and has quite disappeared from the district. It is a native of the Tyrolese Alps, and was formerly much cultivated as a medicinal plant and for its beauty. This, you will observe, is another introduced plant occurring near Balvie.

Centaurea Cyanus (the Corn-flower) is an additional instance of a weed that seems to have been more frequently found in cultivated fields in Hopkirk's time than now. It is exceedingly rare as a weed about Glasgow, although it is cultivated in gardens as an annual. The same explanation which I have ventured to give in other cases appears to apply in this one also. *Centaurea Scabiosa* does not occur at all in the district except as a casual.

His list of the *Orchidaceæ* lacks *Malaxis*, which even yet appears to have been found only once within

the limits of his district; *Habenaria chlorantha*, which was still confounded with *H. bifolia; Listera cordata*, which occurs on the hills along the Firth, but had not then been observed there; and *Neottia Nidus-Avis*, which has almost certainly made its appearance in Clydesdale since his time, as Patrick, who knew the plant well, was not aware in 1831 of its occurrence anywhere nearer than Crawfordland Castle, Kilmarnock.

I need hardly say that the troublesome Canadian Pondweed (*Anacharis*) had not in these days invaded our lochs and canals. The Horned Pondweed (*Zannichellia*), though rare, occurred "in the Clyde near the ford, Bogle's Hole."

Typha latifolia he records as growing "in a bog on the banks of the Clyde, about two miles to the east of Hamilton." This station is the Deadwaters at Ferniegair, where the Great Reed-mace still flourishes. Patrick in his book reminds us, with reference to this plant, that "Rubens has put it into the hand of Christ as a sceptre, when He was saluted as a King in mockery by Herod's soldiers."

For the Dwarf Birch (*Betula nana*) he quotes Lightfoot's Clydesdale station. What Lightfoot actually says is: "It has been found also in the lowlands, as on the lands of *Bertram*, about a mile from *Carnwath*, in *Clydesdale*." From the wording of this it does not appear that Lightfoot had himself found the plant there, and he does not say on what authority he makes the statement. Hopkirk gives the station on Lightfoot's authority, but he does not quote Lightfoot's words. He says: "At Bertram, about a mile from Carnwath." I think this rather fortunate, as I believe it enables us to conclude that he had not visited the station himself. There is no place known as Bertram near Carnwath; but the family of Bertram have long possessed lands there, and Kersewell, their residence, is about a mile from Carnwath. Lightfoot in referring to "the lands of Bertram" meant the lands belonging

to Bertram—not that Bertram was the name of the estate; and when we find Hopkirk mistaking the name of the proprietor for that of the place, I think we are justified in inferring that he had not personally visited the locality. Patrick gives the station without quoting any authority, as if acquainted with it, thus—"on the estate of Bertram, near Carnwath"; but from his not giving the actual name of the place, which a perception of the ambiguity of Lightfoot's words would almost certainly have led him to do, I conclude that he too proceeded on Lightfoot's authority, merely using the word "estate" instead of "lands," and not being aware that Bertram was the proprietor's name. Hennedy gives the station on Lightfoot's authority; but his quotation is from Hopkirk, and not from Lightfoot—"At Bertram, near Carnwath"—and so I infer that he, too, had not verified the occurrence of the plant there. In the "Fauna and Flora of the West of Scotland," 1876, this station is the only one given for the plant. A few years ago I made inquiries as to its occurrence near Carnwath; and I have as yet been unable to discover any evidence of its having been found there for a long time. I visited Carnwath and made a search for it, especially on the Kersewell estate, but unsuccessfully. I inquired about it at several persons who might have been expected to know, but without result. The locality is not a likely one for a plant of Highland type, that prefers a mountainous district; Lightfoot's statement appears to be made on the authority of some person unknown; all our subsequent Floras merely quote without verifying; and the plant is not known, so far as I am aware, to have been observed there by any living botanist. On these grounds I think we may conclude that this is a mere traditional station, and drop it from our lists as a case of error or extinction.

Arum maculatum still grows about Bothwell and Hamilton, but there can be little doubt that it has been introduced.

Poterium Sanguisorba, which is not mentioned by Hennedy, he records for "dry sandy banks near the Clyde, Dalbeth." It does not now seem to occur there, and has no claim to be considered native though occasionally found. Specimens have recently been gathered on a railway-cutting near Old Kilpatrick.

With regard to the Willows, of which his list includes ten kinds, the critical determination of species has been so fully developed since his time that it would serve little purpose to institute a comparison.

He records the whole of the *Juncaceæ* still known to occur about Glasgow.

Of the Grasses, Hennedy gives seventeen species more than Hopkirk; but most of these are found on the shores of the Firth, or on mountains not included in Hopkirk's district. One grass—*Lepturus filiformis*—which occurs abundantly between Greenock and Gourock, is not mentioned either by Hopkirk or Hennedy. Among those which grow in the district embraced by the *Flora Glottiana*, and which are not mentioned, are: *Melica nutans* (rare), *Kœleria cristata* (rare), *Avena fatua* (a weed), *Avena strigosa* (a weed), *Poa aquatica* (which has perhaps extended into the district since his time), *Poa maritima* (occurring on the coast at the very limits of his district), *Bromus secalinus* (not indigenous, and probably introduced with seed), and one or two others. One species mentioned by him—*Panicum sanguinale*—of which he found only one plant, though common on the Continent, is not a native of Britain.

Of *Carices* he enumerates twenty-eight species. His *recurva*, *cæspitosa*, and *stricta* seem to be *glauca*, Scop., *vulgaris*, Fries, and *aquatilis*, Wahl., var. *Watsoni*, respectively. He gives *depauperata* as very rare, but occurring in a small wood near Balvie. Here it may have been introduced, as George Don had it in cultivation in his garden in Forfar. Balvie was evidently at this time a centre about which

cultivated plants were appearing in somewhat wild places (as in the case of *Achillea tomentosa*), whether deliberately or accidentally introduced cannot now be determined. This *Carex* does not seem to be known at all hereabouts, and there can be little doubt that it had either been introduced or an error made in its determination. Several of the species enumerated by Hennedy do not occur within Hopkirk's district; but he appears to have overlooked *fulva*, *binervis*, and *pendula*. With reference to the last, Hooker in his *Flora Scotica* (1821) gives as stations, "Woods, Bothwell, and a little to the east of Blantyre Priory," quoting Hopkirk as his authority. Patrick (1831) appears to have been more familiar with the distribution of the plant, as he adds to these stations: "by the Avon at Haughhead, and above Barncluith very abundant." Hopkirk records *lævigata* as occurring "in a marsh near Glasgow" on the authority of J. Mackay. Patrick says in "wet woods E. of Mugdock Castle." The shores of the lower part of the Firth seem to be the nearest localities where the plant has of late been found.

Of the other *Cyperaceæ*, *Schœnus nigricans* and *Blysmus compressus*, which hardly occur within the limits of Hopkirk's district, are not recorded. *Blysmus rufus*, *Rhynchospora alba*, *Eleocharis palustris*, *E. acicularis*, *Isolepis fluitans*, *I. setacea*, *Scirpus lacustris*, *S. maritimus*, *S. sylvaticus*, *S. pauciflorus*, *S. cæspitosus*, and three species of *Eriophorum* are all recorded by him under the various names by which they were then generally recognised by botanists. *Scirpus Tabernæmontani*, which occurs along the margin of his district on both sides of the Clyde, is not recorded by him.

Of the *Equisetaceæ* he gives all the species enumerated by Hennedy except *Equisetum Telmateia** and

* That he had observed this conspicuous plant, but had only regarded it as an exceedingly large form of another species, appears from a remark in his *Flora Anomoia*: "The Wood Horse-tail *(Equisetum sylvaticum)* is found in wet rich ground (as in the woods of Lanark) nearly six feet high, whilst in dry pastures and on the road-sides it is never above one."

E. umbrosum. *Isoetes* is stated to be found in Mugdock Loch; Ure's station—"in the pond at Galloflat"—is quoted for *Pilularia;* and the four species of *Lycopodium* that still occur are given.

The Ferns recognised are *Polypodium vulgare*, *P. Phegopteris*, *P. Dryopteris*, *Aspidium aculeatum*, *A. lobatum*, *Lastrea Oreopteris*, *L. Filix-mas*, *L. dilatata*, *Cystopteris fragilis*, *Asplenium Filix-fœmina*, *A. Adiantum-nigrum*, *A. Ruta-muraria*, *A. Trichomanes*, *Scolopendrium vulgare*, *Pteris aquilina*, *Blechnum boreale*, *Osmunda regalis*, and *Ophioglossum vulgatum*. He gives also *Aspidium Lonchitis*, on the authority of Ure, as occurring "in fissures of rocks below Calderwood." He adds in a note: "I have frequently sought for this fern, without success; perhaps the young plants of *A. aculeatum* may have been mistaken for it." This is more than likely.

Of the Ferns unrecorded, *Cryptogramme crispa*, though uncommon, occurs in the district; *Aspidium angulare* near Helensburgh, at his limit sea-ward; *Asplenium viride*, at the Falls of Clyde, his limit inland; and *Botrychium Lunaria* on Neilston Pad, Cathkin Hills, Mearns Moor, &c. *Aspidium angulare* and *Asplenium viride* thus hardly occur in his district, while the Parsley Fern and the Moonwort are both uncommon. The latter, though the more frequent, does not readily catch the eye.

Into a consideration in detail of his lists of Mosses, Algæ, and Fungi, I shall not enter. They are admittedly very incomplete, and of them he observes in his preface: "That the list of Plants in the class Cryptogamia is imperfect, I am aware; but from the idea that it may prove useful to the Botanical Student to know the most general Cryptogamous inhabitants of this part of Scotland, I have been induced to insert it, limited though it is."

The following genera of Mosses are included in his list, the numerals within brackets denoting the number of species which he gives for each genus: Sphagnum (2), Phascum (3), Gymnostomum (3),

Splachnum (2), Encalypta (1), Grimmia (2), Dicranum (6), Trichostomum (2), Tortula (6), Orthotrichum (2), Hypnum (26), Fontinalis (2), Funaria (1), Bartramia (2), Mnium (1), Bryum (11), and Polytrichum (8). The nomenclature has, however, been very much altered since his time, not only in these cases, but in the whole of the Cryptogamia. Of Hepaticæ, he enumerates 16 species of Jungermannia, and 2 species and 1 variety of Marchantia.

Under Algæ, he gives 55 species of Lichen, 4 of Lepraria, 10 of Tremella, 23 of Conferva, 1 of Rivularia, and 1 of Ulva.

In a note to the list of Algæ, above referred to, he says: "Several species of Fuci and Ulvæ are to be found at the mouth of the River Clyde, but they scarcely come within the limits of the present Catalogue. The following, however, I have collected on the shore at Helensburgh." He then enumerates 22 species of Fucus and 3 of Ulva.

Under Fungi, he gives Merulius (3), Agaricus (39), Boletus (10), Hydnum (1), Helvella (2), Auricularia (4), Peziza (7), Phallus (2), Clavaria (7, and 3 vars.), Lycoperdon (4), Reticularia (4), Sphæria (8), Trichia (1), Mucor (4).

To these Fungi fall to be added the 10 species of Tremella recorded under Algæ. We find Greville in 1824, with reference to the Edinburgh district, writing as follows: "Few Cryptogamic vegetables had been detected or even sought for; and among the Hypoxyla, Fungi, Gastromyci, Byssoideæ, and Epiphytæ, scarcely half-a-dozen species were on record." How much, then, does it say for Hopkirk's assiduity that eleven years before this he had chronicled in all upwards of a hundred species of Fungi for the Glasgow district!

A few extracts from his notes on these plants may be of interest, and will show how close and acute an observer he was, and how curiously he watched these strange forms of vegetation, and sought to read the mysteries of their life-history.

Under the name of *Tremella Sabinæ* he records the Savin Podisoma *(P. Sabinæ*, Fr.), which is now recognised as a state of the *Rœstelia cancellata* on leaves of the Pear. He says of it :

"For several years past, this singular production has regularly made its appearance about the middle of May, upon a young plant of the *Juniperus Sabina*, in Dalbeth garden.

"When examined by a good microscope, it seems to consist of a mass of fibres running irregularly across each other, interspersed with many opaque, globular bodies, probably the seed.

"Last summer I cut a branch of the Savine tree, upon which this plant was accustomed to grow, almost in two, so as to occasion its death. The rudiments of the Tremella made their appearance upon the dead branch at the same time with those upon the living ones; but the former scarcely attained the size of a large pin-head, whilst the latter in the course of two days attained their full size, being nearly an inch long.

"From this circumstance, from its regularity in appearing within a few days of the same time each year, and from its indissolubility not only in water but even in spirits—having kept a quantity of it in spirit of wine for nearly two years without any dissolution of its substance—I am much inclined to suppose it a vegetable, and not merely a gummy exudation."

This you will all admit to be a rational conclusion.

Of the Scotch Bonnets *(Marasmius oreades*, Fr.) he says: "On the ground in pastures, frequently forming circles called fairy rings."

He observes of the Horse Mushroom *(Agaricus Georgii*, Sow., *Psalliota arvensis*, Schœff.):

"A plant . . . probably of this species was found in the neighbourhood of Paisley, which was nine inches high, forty-three in circumference, and weighed five pounds, six ounces."

Another of great size which he chronicles is the Scaly Boletus *(B. squamosus)*. He says:

"A plant of this species has regularly made its appearance for several years past on the stump of an ash-tree at Dalbeth.

"In 1810 it attained an extraordinary size, being seven feet five inches in circumference, and weighing, after having been cut four days, thirty-four pounds avoird. It was only four weeks in attaining the above size, gaining thus an acquisition of weight of above one pound three ounces in the day."

Peziza coccinea, the beautiful Scarlet Peziza, is recorded in the *Fauna and Flora of the West of Scotland* as common; but that list, I regret to say, is, so far as the Fungi are concerned, somewhat unreliable. This Peziza is certainly not common in the district, but is found occasionally. Hopkirk says of it:

"On rotten sticks in woods. A group of about ten of this beautiful species I found in Hamilton Wood, on an old branch of a tree, during the last autumn."

Of necessity I have reviewed Hopkirk's work from the coign of vantage of to-day, and it has accordingly been more my task to point out wherein he fell short than to call attention to what he actually did. It is easy now, from the accumulated observations of many, to show the errors and omissions of the one who laboured in the new field. The district was before him with hardly a landmark to guide. He was the pioneer who blazed his way where we later men run smoothly on firm roads. We sally out a-botanising equipped with a knowledge of plants and localities that has been growing from more to more these seventy years. Our occasional divergencies from the highway form new beaten tracks that may make it still easier for those who come after. In estimating Hopkirk's labours, however, we are bound to consider the state of knowledge then and the difficulties he had to face. Could anyone of us put himself back to 1813 and into Hopkirk's stead, and then set about the making of

the *Flora Glottiana*, he would find it no child's play. Hard and disheartening would be the position, with scarcely a kindred spirit to aid and sympathise; for though there might be herbalists enough and to spare, scientific botanists would be almost unknown. Watching and wandering about the countryside would lack the modern facilities of railway travelling, while occasionally man-traps and spring-guns would have to be guarded against. Descriptions of species would be frequently incorrect, seldom precise, and verification by comparison with authentic specimens would be sadly hampered by restricted means of communication and conveyance. Instruments and appliances for more minute observation would appear rude and unsatisfactory. In short, the man would speedily wish himself back again into this year of grace. The *Flora Glottiana* was a laborious undertaking, and Hopkirk accomplished it successfully. That a few of the plants of the district escaped his notice is not to field-botanists a matter of surprise; their wonder is rather that he recognised and recorded so many. The study of minute shades of difference in insignificant herbs was one to which few minds inclined amidst the deadly grapple of nations and the wild rush of world-events that filled the time with battles and bloodshed. Hopkirk's enthusiasm was great as his assiduity, and so he became the PIONEER BOTANIST OF CLYDESDALE.

The additions to the lists of our phanerogamic flora since his day have not really been numerous. They consist mainly of species that were then segregated, more rarely of species overlooked, or of such as have since made their way into the district. The plants that have disappeared seem in most cases never to have been truly naturalised. In the general wreck of the original land-surface hereabouts since Hopkirk's time by pit, quarry, railway, road, draining, levelling, housebuilding, &c., it is astonishing that the changes in the flora have not

been greater. The havoc wrought by all that cutting and carving has probably been for the benefit of the community; and I am sure that, were Hopkirk to return to Dalbeth and ramble about as in the olden time, his generous heart would rejoice at the advance in material prosperity, and he would be consoled for the absence of the few plants lost to the district.

In the same year (1813) in which the *Flora Glottiana* was published, and from the same press, there was issued a *Catalogue of the Plants, indigenous and exotic, cultivated in the Garden, Dalbeth.* *

From this list I find that in 1813 there grew in Dalbeth Garden—disregarding the varieties enumerated, except in a few cases where I think there is sufficient reason to include them—no less than 2,253 different kinds of plants, of which 1,054 are marked as indigenous and 1,199 as exotic. Many additions continued to be made to the collection, and a Supplement to the Catalogue was printed in 1815, in which 1,135 additional species are enumerated, including 121 indigenous and 1,014 exotic. How Hopkirk disposed of this fine collection I daresay you are all aware, and to that I shall again refer.

His next work was entitled: *Flora Anomoia: A General View of the Anomalies in the Vegetable Kingdom.* It was published in 1817 at Glasgow by John Smith & Son.

The object of the work was—using Hopkirk's own language—"to exhibit in one view the anomalies which take place amongst vegetables, by collecting together such as are recorded, or have come under the author's own observation." These he arranges under four general heads, viz., the Anomalies of the Root, of the Stem and Branches,

* This little book is now rare, and for a copy my thanks are due to Mr. Joseph Christie, who is so well known as a Glasgow Botanist. It is interesting to note that besides being printed in this city, the paper used was made here, and is water-marked —"R. Collins, 1806."

of the Leaf, and of the Flower, including its separate parts and the fruit. This arrangement according to the organs affected was the one at that time generally adopted. It was in the state of science perhaps the only one then possible, and had, at least, convenience to recommend it. In Dr. Masters' *Vegetable Teratology*, abnormalities are arranged primarily according to the nature of the deviations themselves, which is a more strictly scientific method of dealing with the subject. Hopkirk's merit consists in recognising the importance of the study of malformations, at a time when these received little notice, or were regarded as merely curious freaks of nature. Linnæus devoted some attention to them, but it was undoubtedly the morphological hypotheses of Goethe that first drew the regard of botanists to their real scientific value. Hopkirk's was almost the earliest British response to the clear-sounding keynote from Germany, and his book was the first general treatise on the subject in the English language. His work was imperfect, no doubt, as all such work must be. Goethe's hypotheses even were but gropings in the dark, though he stumbled against truths, as men of genius have a knack of doing. Still, these men are not gods, knowing all things intuitively; their merit lies in being able to recognise the far-off peak hidden from the purblind multitude. Though successive generations pile up the edifice, the honour of laying firm foundation-stones in the darkness is great. It would be unreasonable to criticise this work of Hopkirk's from the standpoint of to-day, and so I shall merely refer to a few things worthy of note. He perhaps regarded this as his *magnum opus*, a dissipating of bewildering hazes, a laying of secure ways; but we can hardly nowadays forget in reading it that it was written nearly seventy years ago, and that many of its theories have grown somewhat grey. The facts observed and recorded are, however, still instructive and interesting.

Hopkirk had much artistic taste and skill. The title-page has an edging of twining *Corydalis vesicaria*, —a plant with bladder-like capsules, two of which he represents as open in order to show the disposition of the seed. The other plates are after his sketches, with the exception of one which is executed from impressions made from the leaves of a variety of beech.

In discussing the Anomalies of the Root, he refers in the first place to plants living entirely in the water (as Duckweeds and Seaweeds), and then to parasitic plants (as Dodder and Mistletoe). Many root anomalies he attributes to excess or deficiency of moisture, and he adduces in support the case of roots accidentally immersed in water, when the woody and solid part becomes divided into many fibres, as often seen in Willows and in the Cowbane *(Cicuta virosa)*. He also says of the Impatient Balsam *(Impatiens Noli-me-tangere)* that if grown in a dry soil its roots are shorter, fleshier, and less divided than if in moist ground, while if wholly in water they are much drawn out and fibrous. He figures the various forms of the roots of this plant to illustrate the difference. On the other hand, he points out that when plants are removed from a wet to a dry soil, fibrous roots sometimes become bulbous or succulent, as in the cases of the Jointed Fox-tail grass (*Alopecurus geniculatus)*, and the Meadow Cat's-tail grass *(Phleum pratense)*. He refers to exposed trees as having stronger and longer roots against the direction of prevailing winds, and adds that in this country trees generally incline to the north-east and have their longest roots to the south-west, and that accordingly when there is a violent storm from the north-east, many more trees are blown down than by a gale from the opposite quarter.

Knobs, burs, or tumours on the stem or branches, he considers to be frequently occasioned by deficiency of moisture, and to be in themselves the rudiments of

new roots. He adds that on old fruit-trees such burs occur frequently, and that gardeners take advantage of their readiness to root, by cutting off, when the fruit is setting, a branch immediately below one of the burs, and planting it, whereupon the roots shoot out so rapidly that the branch is supplied with nourishment and the fruit perfected. This method of propagation, he says, had begun to be adopted with some success, trees so raised bearing fruit earlier than by grafting, as might be seen at Lancefield at the time when he was writing (September, 1816), where there were several young trees loaded with fruit though planted only the preceding season. He shows elsewhere, however, that other causes come into play in the formation of burs, such as too large a supply or improper direction of the sap, the bite of insects, or the rupture of vessels. "An undue determination of sap towards one particular branch is," he says, "the cause of the bunches or knots so frequently to be observed in the Birch; the knot being plentifully supplied with nourishment sends out many shoots and twigs, and forms the bushy appearance called the Witch Knot." Kurt Sprengel, a celebrated German botanist of that time, quotes from Hopkirk, and states that these Witch Knots consist of buds intermingled in a great variety of ways, from which, however, no proper branches proceed, but only a crowd of thin twigs forming a bush-like mass, and that similar knots were often found in the pines of the very dry sandy plains of Germany.

The extraordinary exertions made by plants straitened for nourishment he illustrates by the case of a Plane-tree (presumably *Acer pseudo-platanus*) that grew amongst the ruins of New Abbey, in Galloway, on the top of a wall about 20 feet above the ground. The nourishment in such a situation being insufficient, roots were thrown out till they reached the ground, after which the tree made vigorous progress. Another instance he adduces is

that of new roots being formed above partially broken parts of the brittle stem of *Impatiens Noli-me-tangere*, which lengthened till they reached the earth. He refers to the Banyan-tree as a striking example of this tendency, and gives many instances of leaves and stems sending forth roots. He also treats of the variations in the shape and colour of roots.

The anomalies of the stem and branches he refers to the effects of soil, climate, and cultivation, and shows how these causes affect the development of thorns, prickles, and hairs. Age he also gives as a factor that makes some plants jagged and cantankerous, as *Astragalus Tragacanthi*, and some of the *Mimosæ*.

"The tendrils of Vines," he says, "occasionally produce flowers and bear fruit, from which it would seem that they are only abortive branches; and in the Bladdered Fumitory *(Corydalis vesicaria)* . . . . the ends of the branches are terminated with tendrils, which frequently change either partially or entirely into leaves." The importance of these observations will be more fully comprehended on reference to Darwin's *Movements and Habits of Climbing Plants* and his remarks on *Corydalis claviculata* and *Vitis vinifera*.

Hopkirk deals with grafting, natural and artificial. He recognises the fact that no new varieties are produced by grafting, but that it preserves and propagates those already existing. He dismisses the absurdities of the old writers as to grafts on trees of quite different natures. "It is, however," he adds in a note, "a very surprising and altogether unaccountable circumstance that plants which do not lose their leaves and are evergreen can be grafted upon others which are deciduous, provided they are nearly allied. Thus, the Common Laurel *(Prunus Lauro-Cerasus)* may be grafted upon the Perfumed Cherry Tree *(Prunus Mahaleb)*, and the Broad-leaved Medlar

(Mespilus japonica) upon the common one *(M. germanica)*." Sprengel quotes Hopkirk, and adds that it is certain that evergreens may be propagated on plants that are deciduous, if they belong to the same genus.

The nature and formation of galls on branches and buds is then discussed, and he afterwards takes up the same subject in connection with the Anomalies of the Leaf. Referring to galls on the Oak, he observes that in 1815 these trees about Glasgow were much infested by gall-producing insects, and that the galls themselves were frequently as large as a small apple. He notices the galls on the Rose-Willow and the Wild Rose, and states that the Bedeguar of the latter had formerly been much used in medicine in cases of dysentery, &c. Of another well-known gall he says: "A very singular one may be found on the under surface of the Oak leaf in great abundance in the months of August and September, of a flat shape similar to a button, closely attached to the leaf by a very small footstalk, and covered round the edges with fine reddish or brown filaments. This pretty species owes its origin to a whitish worm, so very minute as not to be perceived without the assistance of a glass." On this Sprengel observes that these curious bodies have been called *Xyloma pezizoides* and *Sclerotium fasciculatum*, but he adds that they have been best examined by Hopkirk.

Hopkirk warns his readers not to attribute all kinds of knots and swellings on stems to insect agency, and refers to thickenings and distortions on the Shepherd's Purse *(Capsella Bursa-pastoris)* that are due to the stimulus of a parasitic fungus.

He proceeds to consider the weeping varieties of trees, and is of opinion that while in some cases extreme slenderness or pliability of branch accounts for these, in others, such as the weeping ash, there is a propensity to grow downwards that no care can overcome. He mentions many other variations,

as in the colour of branches and the like, and discusses the causes that induce some annual plants to become biennial and even perennial, and how others, that in their natural state live for many years, get restricted to one.

In treating of the Anomalies of the Leaf, he takes up the variations that occur in number, size, shape, pubescence, division, &c. He shows how leaves are frequently found where they ought not to be, replacing petals and other parts of the flower; how some with flat and even surfaces become wrinkled and crisped and curled; and how others cease to be deciduous and get to be permanent and evergreen. With regard to colour he points out that variegated leaves are seldom altogether white, and that when not irregularly blotched, they are usually striped either longitudinally or round the edges. Leaves with brown or black markings, he observes, often retain or lose this appearance according to the soil in which the plants grow. He refers to a variety of the Olive with leaves entirely brown, to the Copper-coloured Beech, and the Red Cabbage; and he shows that in these cases the peculiarity of colour arises from the epidermis being tinted, while in most plants it is transparent and without tinge and thus transmits the green colour of the deeper-seated tissues unaltered. He gives some curious instances of etiolation and variegation which had come under his notice.

In treating of the Anomalies of the Flower he begins with the calyx. Besides mentioning its occasional enlargement, thickening, and additional segmentation, he refers to the singular case of a multiplied form in the Clove Pink *(Dianthus Caryophyllus)* quoted by Linnæus, and figured in Curtis' *Botanical Magazine.* The case of *Calla palustris* is also of interest. It has normally a large spreading one-leaved spathe; but when cultivated it has sometimes two spathes instead of one. This abnormality, we find, occurred repeatedly in a plant

cultivated in Dalbeth Garden, and Hopkirk in a plate represents both the natural appearance and the variety. Calices, ordinarily green, are not uncommonly found petaloid. "When in consequence of cold or wet seasons," says Hopkirk, "the corolla of the Wood Crowfoot *(Ranunculus auricomus)* becomes diminished in size or is altogether wanting, the leaves of the calyx increase in size, and assume —either partially on one side or entirely—the yellow colour of the petals. In the same manner the tubular perianth in many varieties of *Primulæ* becomes enlarged, and acquires the yellow or red colour of the corolla. This variety in the *Polyanthus* is well known to florists under the name of Hose-in-hose." He gives other instances, and in a note refers to the remarkable transitions of colour in the calyx of *Gladiolus versicolor*, which is stated to be brown in the morning, and to change colour gradually during the day, till towards evening it is a clear blue, and so on day by day till the flower fades.

In our days we are somewhat familiar with cleistogamous flowers, but it was with some surprise that I first read the following passage in the *Flora Anomoia*. "The *Viola odorata*, *palustris*, and *canina* have their late flowers sometimes without petals, and a plant of the latter which I found without petals and transplanted into the garden, continued so for two years, during which time it regularly produced seed."

At some length he enters into a consideration of "double" flowers, and how they arise. His list "of *multiplicate* or *full* flowers, commonly called *semi-double* and *double* flowers," comprises 147 species.

He adduces many other instances of corollar deviation,—transformations of petals and stamens into nectaries, regular flowers into irregular, and so on. Regular Peloria he gives instances of, while irregular Peloria is illustrated in plate vii., figs. 1, 2, and 3, as exhibited by *Linaria vulgaris*. In plate ix. he represents proliferous flowers of the Rose. The

Hen-and-Chicken Daisy and like deviations, viviparous development, the formation of bulbs instead of seed and on the stems or in the axils of leaves, are also described.

Colour variation forms one of the subjects of his observation and research, and he gives several lists of plants that "run" from one colour to another.

He concludes his work by an account of some of the anomalies in fruits, and treats of their manifold variation in form, flavour, colour and perfume, as well as of their becoming double, having neither stone nor kernel, and the like.

This is only a very imperfect sketch of the first book in the English language wholly confined to teratological questions; but it may serve to give some idea of its merit as a forerunner of the advanced knowledge of to-day.

I have already incidentally referred to Hopkirk's connection with the Royal Botanic Garden of Glasgow. To him is undoubtedly due the credit of being Founder of the Institution. His enthusiasm secured for the city this boon of blossom and greenery, which may have served to sweeten the weary round of many a life, and to relieve somewhat the monotony of the grimy environment. For nearly seventy years the Institution has maintained garden-grounds and conservatories, often under many difficulties; and everyone who is interested in plant life or takes any delight in the beauties of vegetation must earnestly desire that whatever changes may come, such agreeable places of recreation and instruction shall never be numbered with the past things of the city. The public parks of our day are the outcome of a popular movement after pleasant places of resort, and Hopkirk's ideas were happy anticipations of the spirit of this later time. He was the first about Glasgow who succeeded in giving practical effect to such a movement. As the municipal authorities had not then advanced to the conception of such

pleasant places being needed, the attempt had to be made on another basis.

At the beginning of the century a small piece of ground off High Street near the College was known as the "Physic Garden," and it had long been devoted to the cultivation of plants illustrative of botany. This science did not then take any very prominent position in the College course; and Dr. James Jeffray occupied the double Chair of Anatomy and Botany, dividing his attention between the dissection of the bodies provided by the hangman and the study of plants. It became apparent that the situation of this garden was not a suitable one. The blight of stifling manufactories was on all its bloom. In 1816, Hopkirk succeeded in forming a Society to establish a Botanic Garden in the neighbourhood of the city. He secured the support of many of the wealthier citizens, the University agreed to contribute £2000 on certain conditions, and the Society was duly erected into a corporation. It says much for his energy and perseverance, that when there was only a population in Glasgow of 140,000 or so, and wealth immeasurably less than now, he succeeded in getting the public to show in a practical way their appreciation of the beauty of flower and leaf by subscribing the cash needed for laying out gardens and erecting conservatories. Nor did he himself lack a corresponding generosity. We can all feel how hard it is to part with collections brought together during many years of toil and care, and not without expense. Yet he made a gift of the whole of his Dalbeth collection to the new Society, and the Garden was thus stocked from the very day of its opening with several thousand species of plants, many of rare excellence and beauty.

About eight imperial acres of land were purchased to the west of the city between Dumbarton Road and Sandyford. The work was begun on the 15th of May, 1817, and the general arrangements were

carried out under the direction of an interim committee of eight elected by the proprietors, and of this committee I need hardly say Hopkirk was the chief. Office-bearers were elected at a general meeting of the subscribers held towards the close of the same year. Sir Islay Campbell of Succoth, Bart., became president, with Hopkirk as vice-president, and Stewart Murray as curator.

Of this old walled garden I need say little. Not a trace of it now remains. The lodge with its handsome verandah at the north entrance, the greenhouse near the middle of the grounds, the ornamental plots, the rockwork almost surrounded by a pond full of aquatic plants,—these are all long ago things of the past. Streets have obliterated them. To Hopkirk and Stewart Murray fell most of the planning and arrangement of the place, so that it might be at the same time beautiful and instructive; and their work succeeded as all work does in which the heart lies. Professor (afterwards Sir) Wm. J. Hooker was about this time appointed to the Chair of Botany, and he rendered great assistance. By the year 1821 the Garden contained upwards of 9000 species. Two woodcuts in Loudon's *Encyclopædia of Gardening* (2nd Edition, 1824) give some idea of the Garden as it was then,—the one a plan of the grounds, the other a view of the hothouses and their surroundings.

Some time after the Garden was opened, a little book was published—written by the Curator—which contains many interesting details as to the place and the plants there. It is entitled, *Companion to the Glasgow Botanic Garden, or popular notices of some of the more remarkable plants contained in it.* In some of the copies there is a plan of the old Garden. From this little work, I find that there were different plots set apart for collections of hardy herbaceous plants, medical plants for illustrating the lectures at College and for sale, plants used in agriculture, or esteemed as esculents, or of economic

importance; and also American and Scottish Departments, and a classified arrangement for the use of students. The system followed in the general collection was based on that of Linnæus; but the writer adds that "it is proposed to have a small arrangement illustrative of the method of Jussieu, now much adopted in the Continental gardens." A long list follows of the plants in the stoves, which shows what an extensive collection had been already formed. The first of the stove plants that is mentioned in the list is *Strelitzia Reginæ*, and it is of some interest to learn further that this beautiful exotic was the first plant that flowered in the Glasgow Botanic Garden.

After twenty years it became desirable, owing to the extension of the city, that another site should be chosen. New Gardens were accordingly laid out on the western bank of the Kelvin in the picturesque situation which they still occupy, and these were opened on the last day of April, 1842.

Hopkirk continued to be Vice-President of this Institution till the end of 1830, when he retired. The proprietors had in 1819 voted a present of plate to him of a hundred guineas value, in recognition of his liberal donations o plants and his services generally in forwarding the interests of the Institution. At that time he begged that they would delay the testimonial till the funds of the Institution were in a better state. After he had retired from office, however, they insisted that he should accept the presentation, and he complied.

In the second decade of the century, lithography was comparatively a new art. Hopkirk began to turn his attention to it about 1818, and his name is the first identified with its introduction to Glasgow. He was personally engaged for several years doing lithographic work, till he had instructed others. Peter Mackenzie, in his *Reminiscences of Glasgow*, writing of the year 1828, says that Hopkirk had then become "one of the first lithographic writers

in the city." In June, 1825, Hopkirk undertook the responsibility of editing and managing the issue of a comic illustrated paper, entitled *The Glasgow Looking-Glass*, of which the name was afterwards changed to *The Northern Looking-Glass*. This was the first paper of the kind published here. It is a demy folio, each number consisting of four pages, usually three of these wholly devoted to illustrations. The sketches are mostly of a humorous kind, caricatures of persons and illustrations of current events or matters of interest at the time. Common impressions were sold at 1s. 6d. each number, the best at 2s., and coloured ones at a higher rate. The earlier numbers were produced entirely by a lithographic process, while the plates in the later ones were printed from etchings on copper. Hopkirk himself appears to have done a large part of the work, including some fac-similes of handwriting; but most of the illustrations are by Heath, an artist who came from London, and who evidently possessed both skill and a sense of humour.

This venture was, I suppose, unremunerative, as the issue ceased in the following year. Copies are now valuable, owing to the sketches of scenes, places, and people in old Glasgow. Complete sets are rare, and highly prized by book-collectors.*

A striking feature in the *Looking-Glass*, underlying the humour and caricature, is the prompting given towards increasing the amenities of the city. An unsightliness is indicated for removal; it is shown how ordinary places may be made ornamental, and how the natural beauty of others may be heightened. Hopkirk loved agreeable surroundings, and he was

* The office from which this paper was issued was situated in part of the area now occupied by Anderson's College in George Street. In Atkinson's *Ant* (Glasgow, 1827) occurs the following passage: "*1825. The Looking-Glass.* A folio collection of sketches, all of them humorous and exaggerated, but few of them simply characteristic, engraved from clever designs by a Mr. Heath, and better suggestions by Mr. H——k."

anxious, as I have already shown, to secure them for his fellow-citizens. He was so fond of gardens and green fields that every neglected or waste piece of ground about the city was an eyesore to him as a lost opportunity of common good.

In the very first number is a clever sketch of George Square in these days of ignorant misuse, which had a direct result in bringing about its proper enclosure. In the second number, under the heading "Fashionable Promenade," there is a view of part of the Royal Botanic Garden, and the following remarks are added: "This fashionable place of resort has this season been more numerously attended than ever. We observe that additional grass walks have been added to the Promenade ground, and the excellent Trumpet Band of the 5th Dragoons, we believe, will be in attendance on Saturday next. The splendid *Cactus speciosissimus*, which has been in flower for some time past, has given increased interest to the houses. *Vide et crede.*"

The arrangements for the erection of a monument to John Knox had just been completed, and Hopkirk was one of the five members of the superintending committee. His connection with this movement may have developed in his active mind the scheme of far-reaching proportions which is suggested in the third number of the *Looking-Glass*. It is a happy anticipation of the future, for which the credit is undoubtedly due to him. Under the heading, "Merchants' Park—Monument to John Knox," there is a sketch of the Fir Park as a Necropolis, with the following explanation: "The summit of the Merchants' or Fir Park, as it is called, is now finally fixed upon as the situation for the monument to John Knox. It has been suggested that this piece of ground might be made use of for a burying place, a monumental garden we may call it, similar to the celebrated Père-la-Chaise at Paris; the effect would be beautiful, and its vicinity to the Cathedral would add much to its interest. We have given a

sketch of the Park, supposing it turned to this purpose. A neat bridge might be thrown across the burn from the High Church-yard. We seriously recommend this hint to the Merchants' House, both as a matter of taste and in a pecuniary point of view." Hopkirk, writing in 1837, expresses his gratification at having been the first to suggest the conversion of the Fir Park into a Necropolis. It was the first garden cemetery in Scotland, and was opened in 1832.

In the year 1835, the University of Glasgow conferred on him the degree of LL.D. in recognition of his scientific attainments.

In 1837, Dr. Hopkirk published anonymously a popular book, entitled *The Juvenile Calendar; or Natural History of the Year.* (Rothesay: William Glass.) This is a pleasant little treatise, originally drawn up for his own family, and it is written in a racy easy style. In it we perceive the work of one to whom all Nature was a delight. The unfolding of Spring, the blossoming of Summer, the fruitage and leaf-fall and fungi of Autumn, the birds that come and go, the creatures of the wild, the sights and sounds of earth and air and sea, had all a place in his heart as fulfilling the manifold mystery of God's world. The book is not only a talk of green fields and lonely shores and the wonderful things that a naturalist falls in with, but a discourse by a cultured gentleman who knew the world both of books and men. Dragonflies on gossamer wings, butterflies and moths dusted with splendid colouring, curious shells, and creatures that live in them equally curious, hold with flowers and birds a share in his regard. "If it has pleased God," he says, "to create them, surely we need not be ashamed to examine and admire them."

In order to illustrate his versatility as a naturalist, I shall, without entering into a detailed consideration of the book, give the substance of a few of his personal observations.

A pair of swallows began a nest in an outhouse, the door of which was open during the day and usually closed early in the evening. Finding that they were occasionally shut out, they became accustomed to return at an early hour, "and were generally in bed, like good sober birds, before their neighbours, who had access to their nests at all times, had finished taking their suppers." Hopkirk attached a bit of red riband to the leg of each young bird, and they were observed flying about during that summer. Next spring one of the marked birds made its appearance, and remained for some days about its birthplace. Swallows again built in the same situation, but whether the original pair Hopkirk could not say.

A wren began her curious nest on the crossbar of a garden-door in the corner next the hinges, and attached both to door and projecting wall. The gate was usually closed, but had to be opened occasionally in spring, and thus it happened that soon after the wren set to work the gate was opened and the nest crushed. A fresh start was made, but this time some inches from the corner and towards the middle of the crossbar. Still the nest was not clear of the projecting wall, and with the next opening of the door came destruction. With renewed courage and greater wisdom the wren tried its "level best" for the third time, advancing upon the bar, so that when the door was opened the nest swung free of the wall; and there she brought out her young in safety.

In the nest of a pipit-lark, the "moss-cheeper" of our Lowlands, were observed four eggs, one of them being a cuckoo's. All the eggs produced young birds, and the very next day the three small ones were found lying dead on the outside of the nest, while the young cuckoo occupied the whole nest, and was even at this early age larger than its foster-mother. The dead birds were replaced in the nest, but were again found ejected. Though fre-

quently visited, the moss-cheeper continued to feed her voracious nestling, and as an evidence of her care over it, "upon the approach of a cow towards the nest whilst grazing, the little bird fluttered round it in great uneasiness, and on its nearer approach actually pecked at its face, and succeeded in turning it from the spot." To prevent the cuckoo being taken away, the nest with its inmate was for some time removed into the house in the evenings, and replaced in its former situation in the mornings, the lark continuing to supply its wants during the day. When nearly full-fledged it was kept for some days entirely in the house and fed with worms, which it ate greedily from the hand, devouring thirty or forty daily. It appeared to be fond of water, and sucked a finger when dipped in it with much apparent relish. Its foster-mother kept near the house for a day or two, but could not be induced inside, and at last disappeared. The young cuckoo, after living some time in apparent health, was found one morning dead in its nest.

He refers a good deal to birds of passage, to the notes of birds, and to the folk-lore and poesy that has gathered round them. "Many birds cease singing about midsummer . . . but some of them . . . resume their notes in September and October. . . . The redbreast is said to sing only in the autumn, although it sings all through the spring, summer, and autumn; but in the two first seasons, its voice being weak, is not distinguished in the general chorus. The redbreast, like the wren, sings also during winter." Of the snipe he says: "The male bird keeps on the wing for an hour together, mounting like a lark and uttering a shrill piping noise; it then descends making a bleating noise, which is repeated round the nest possessed by the female, especially when she is sitting on her eggs."

"The dislike," he says, "that prevails in Scotland to the yellow-hammer, proceeds not only from the

supposition that it has three drops of the devil's blood in its head, but from the fancy that its notes pronounce the words, 'deil, deil, deil take thee-ee.'"

Among other matters of which he treats are atmospheric phenomena (wind, dew, rain, &c.), frogs and frog-spawn, oysters and "roaring buckies" and other shell-fish, the transformations of insects, and the luminosity of glow-worms and other creatures. There are several descriptions of scenery, and one of the prospect from Ascog in Bute is full of life and colour.

There is much pleasant talk about herbs and trees and garden flowers, and many interesting notes as to plant names and folk-lore; but so much has been already said about Hopkirk as a botanist that I shall restrict myself to one reference. He gives several instances of the enduring vitality of seeds. Some seeds from tree-pinks growing on the walls of Jerusalem were sent him by Lady Liston in a letter that came to hand after much mangling and many fumigations and delays owing to precautions against the plague, and yet plants from them grew in the Glasgow Botanic Garden. He gives other cases, and says: "So late as 1836, a curious instance of this came under my observation. About half a peck of a small sort of seed was taken out of a coffin at Wymondham Abbey, which had been buried there since the year 1100. Some of these seeds were sent to the Glasgow Botanic Garden, and being sown they came up and produced plants of . . . the Red Valerian. It was customary to place certain seeds, such as it, in coffins at that period, and it had retained the powers of vegetation for 736 years."

Besides these published works, Hopkirk drew up a Description of the Barony Parish of Glasgow, which contains many interesting local notes, some of them bearing on Natural History. This book was never published, and the manuscript is now in the possession of James Duncan, Esq. of Benmore.

He took an active part in some public matters besides those to which I have referred. In 1810, he was one of the Managers of Stirling's Library. He was a Justice of Peace for the County of Lanark, and a Commissioner of Assessed Taxes for the Lower Ward. He occupied for a time the honourable position of Provost of the Burgh of Anderston, which shows the esteem in which he was held by those among whom he lived.

After 1830 he did not reside much about Glasgow. He subsequently took up his abode in Ireland, and was for some time connected with the Geological Department of the Ordnance Survey of that country. Part of the *Juvenile Calendar*, published 1837, was written by him whilst spending the summer at Rothesay.

The time came to him that comes to all, when Death claims his due, and joys and sorrows, enthusiasms and regrets, successes and failures, alike fade into cold shadow. He died at Malone, Belfast, on the 24th August, 1841, and was buried there. He was a widower at his decease, and left a young family to deplore his loss.

I have little to add. That his life was a round of industry, what he did clearly testifies. The originality of the work marks the inventive mind of the man. He was the earliest to do and suggest and introduce many things. He struck out new paths in various fields. As a botanist he published the first list of the plants of the Clyde district, he wrote the first English book entirely devoted to Teratology, he succeeded in founding the Glasgow Royal Botanic Institution. By his presence the society of the city in the earlier years of the century was the richer in culture and refinement, and he did his best towards making the city itself beautiful within and without. This sketch puts on record some facts as to his life and work which have been rescued from oblivion, and it may help us to form an estimate of his worth.

Now, on the occasion of publication, I wish to add a few words of explanation and acknowledgment.

The accompanying portrait has been executed from an oil-painting, which I am assured is a good likeness of Hopkirk. The cost of its production in permanent photographic form has been defrayed by a few gentlemen to whom our best thanks are due, as they are also to Mr. William Goodwin for his care and trouble in securing a good negative of the original.

I beg, farther, to thank all who have in any way assisted me in arriving at facts, and it is pleasant for me to reflect on the cordial and ready response which met every enquiry I made. My indebtedness to Dr. Hopkirk's daughter, Miss Christian G. Hopkirk of Belfast, and to his nephew, Mr. Laurence Hill, C.E., of this city, demands special acknowledgment.

The reward of all who have thus aided me will I trust be like my own—a sense of satisfaction in having done something towards the memory of one who in his day did good work both as a citizen and as a naturalist.

XXV.

NOTES ON A HYBRID BETWEEN A BLACK COCK AND A PHEASANT.

BY W. CRAIBE ANGUS.

With one Plate. [III.]

[Read 24th February, 1885.]

So far as the occurrence of rare birds is concerned, the past season has been comparatively barren. I have learned, however, to "keep my eye on Paisley"; and by the kindness of the directorate of the Paisley Museum I am able to show to the Society a hybrid between a male Blackcock and a female Pheasant, the occurrence of which has not hitherto been recorded in Scotland.

The bird is remarkably handsome, and is one of a pair that were hatched in the coops on the grounds of Loudoun Castle, Ayrshire, in the season of 1883. It was killed in December last, and presented to the Museum by the lessee, Mr. Matthew Hodgart. The companion bird, the skin of which is still in the possession of Mr. Hodgart, was shot in November, 1883. Both were males, and their flesh partook of the flavour of the Blackcock rather than that of the Pheasant.

The stomach of the bird last killed contained leaves of plants, seeds of the orache *(Atriplex)*, and quartz.

In contour, or general appearance, both birds partake more of the character of the Blackcock than of the Pheasant; but in size they are superior to either, although the bird last killed hardly turned more than $3\frac{1}{2}$ pounds.

The head, back of the neck, rump, and lower surface of the body, are of a lustrous bluish-brown; back, wing-coverts, and outer webs of the primaries

(of which the third and fourth are the longest), barred or variegated with brownish-white, suggesting the markings of the Pheasant; tibial joints and tail, which is broad and fan-shaped, have the feathers mottled, shading into black at the extremities; red skinny spaces at the eyes as in the Blackcock; feet and claws as in the Pheasant.

The two birds, although strongly resembling each other, differ more particularly in the colouring of the feathers on the lower surface of the body. These, in the bird first killed, are barred with white and brown, suggesting the normal markings of the Pheasant; while, on the bird that longest escaped the gun, the variegated feathers have been replaced by others wholly bluish-brown, doubtless having their origin in the male parent,—indeed, the variation of the plumage in its change towards the adult state shows a tendency towards the sable colouring of the Blackcock and the obliteration of the reddish hues of the Pheasant.

The habits of these birds hardly differed from those of the birds among which they were reared, except that they were shyer, and wandered further from the feeding-ground of the keeper.

In 1871 I recorded in the *Zoologist* the occurrence in Aberdeenshire of a hybrid between a male Pheasant and a barn-door fowl. This bird, like the subject of our notice, partook more of the character of the male than of the female parent, and was predatory in its habits. It wandered far from its roosting-ground,—much further than the Pheasants among which it was bred. It was sometimes absent for a whole week during the day-time, but generally returned at night to roost, perching on the tallest in the group of trees surrounding the quaint house of Tillery where it was hatched.

At an early age it evinced an unsociable and cruel disposition towards the birds—fowls and Pheasants—among which it was reared, and would suffer none of them to come near it. In the spring fol-

lowing its incubation, the bird wrought much havoc among the Pheasants; and the keeper, who in this instance was long-suffering and took great delight in watching its habits, had reluctantly to shoot it to save his brood.

The first recorded hybrid is in White's *Selborne*, and several are recorded in our own *Proceedings*. The oil painting of White's bird was translated into black-and-white, and given in the early editions of the *Selborne*. The original picture still hangs in the house of the reverend author, which has become sacred to all English-speaking pilgrims. In Yarrell's *Birds* are figured two very interesting hybrids; one perched upon the branch of a tree is remarkable as a rendering of the texture of feathers.

The accompanying plate gives the massive grandeur of the bird, and an excellent delineation of the habitat of the species. It was executed by a member of the Society from a drawing by Mr. John M. Swan, who has made a reputation for himself as a painter of animals, not only in France and England but in Holland and New York.

XXVI.

ON SOME HYMENOPTERA (CHIEFLY UNDESCRIBED) FROM JAPAN AND THE PACIFIC.

BY P. CAMERON.

[Read 29th December, 1885.]

THE five following species were collected by Mr. J. J. Walker, R.N., during his last voyage in the Pacific:

POLISTES MACAENSIS.

A specimen taken by Mr. Walker at Tahiti, Society Islands, is probably a form of the variable and widely-distributed *P. macaensis*. The specimen is yellow, variegated with red; and with the vertex in the centre, the occiput, three broad lines on the mesonotum, a broad line (interrupted in the middle) on the pronotum, the pleural sutures broadly, the apex of the scutellum in the middle and a narrow line down the centre, the base and apex of the metanotum, a broad line down its middle and another on each side, an oblique line on the metapleura, the base of the petiole broadly, a transverse line near the middle, the basal three-fourths of the second segment and the other segments with a narrow curved line near the base, black. The legs are yellow, variegated with red; the coxae are broadly marked with black behind and laterally; the trochanters and femora and the hind tibiae are lined with black above. The antennae are yellow, except the upper side of the scape, which is black.

I am inclined to refer this example to *P. macaensis*, on account of the characteristic waved black lines on the abdomen. Another form, which I identify as *P. macaensis*, I have from the Sandwich Islands.

PELOPAEUS CAEMENTARIUS, Drury.

Nuka Hiva Island, Marquesas Islands.

The specimen is identical with some others I have from the Sandwich Islands. The abdomen is entirely black, except two small yellow spots on the side of the second segment; there are two yellow spots on the apex of the metathorax; two spots on the pronotum, the scutellum, post-scutellum, tegulae, and the scape of the antennae are also yellow.

ICHNEUMON PACIFICUS, n.s.

Black; legs, except the coxae and trochanters, red; wings fuscous-violaceous, stigma and nervures black. Antennae involute, stout, about as long as the thorax and head together; scape closely punctured. Head transverse, in front coarsely, on top and behind, finely punctured; behind and below the eyes with scattered punctures; covered with a pale down, longest on the face; clypeus transverse; mandibles piceous, with only one tooth at the apex; palpi dark fuscous; mesonotum shining, bearing scattered punctures; scutellum flat, shining, impunctate; pleurae, breast, and metanotum rugose; supramedian area a little longer than broad, the base rounded, the apex almost transverse; posterior median broad at base, becoming narrower towards the apex; metathorax large, the apex semi-perpendicular, hollowed in the centre; the other areas obsolete; but there is a carina round the top. Petiole shining, impunctate; post-petiole closely punctured, the middle closely longitudinally striated; at the base there is a depression on each side; the other segments finely punctured; the ventral segments pale testaceous at their junction, the apical almost entirely. Coxae coarsely punctured; tips of hind tarsi and apex of tibiae black, hind tarsi considerably longer than the tibiae. Areolet converging at top, 5-angled, the recurrent nervure received a little past the middle.

Length, 13 mm.

Hab. Juan Fernandez Island.

ECHTHROMORPHA WALKERI, n.s.

Black; scape beneath, labrum, clypeus, palpi, orbits narrowly, a small mark beneath the tegulae, a larger one lower down, base of scutellum, post-scutellum, two large marks on metanotum, coxae, trochanters, and all the femora at sides and beneath, anterior tibiae and tarsi, and middle tibiae in front, yellow; wings hyaline, nervures black, stigma fuscous on lower side. Antennae longer than the body, covered with a microscopic pile; third joint one-fourth longer than the succeeding; apical joints produced slightly at base and apex. Head closely punctured, excavated above the antennae, but not so deeply between them, where a triangular elevated portion comes down from the ocelli, immediately in front of which this part is hollowed; face covered with white pubescence; thorax coarsely punctured, the hind part of the meso- and metapleurae longitudinally and coarsely striated; scutellum punctured; post-scutellum impunctate, apical half of metanotum finely transversely aciculate-striated; petiole transversely striated, hollowed (very broadly at the base) in the middle. The other segments strongly punctured, broadly white at the apex laterally; a transverse suture at apex of the white marks, interrupted in the middle; areolet subpetiolate.

Long. 11·5 mm.

Hab. Tahiti, Society Islands (J. J. Walker).

The species of this genus are only known from Oceanic Islands; *E. maculipennis*, Holm., from the Sandwich Islands, *E. atrata*, Holm., from St. Helena, and *E. mixta*, Hlm., from Ascension.

EVANIA CURVINERVIS, n.s.

Similar in coloration to and somewhat larger and stouter than *E. laevigata*, Latr.; but differing from it in the antennae being slightly shorter in proportion to the body, and stouter; in the pubescence being much denser; in the front being more deeply excavated and without any keel; in the pro- and

mesothorax having much fewer punctures (there are only some fifteen on the middle lobe of the mesonotum); in the furrow in the centre of the lateral lobes of mesonotum being almost obsolete; in the reticulation on the metathorax being stronger; in the petiole being stouter, more produced at the apex beneath, and furrowed laterally; in the praebrachial transverse nervure being received nearer the base of the stigma, so that the part of the first cubital cellule bounded by it is longer than that bounded by the nervure and the apex of the stigma, the opposite being the case with *E. laevigata*; the nervure itself being also distinctly curved; the first cubital cellule is shorter and wider, being nearly as long as broad, while in *laevigata* it is longer than broad; the base on the lower side of the cellule in *laevigata*, too, forming a sharp angle at its juncture with the recurrent nervure, and not, as in the present species, a curve; the recurrent nervure is distinctly curved, is not interstitial, but is joined to the cubitus by a short pedicel. The mandibles have one large apical tooth.

Hab. Tahiti, Society Islands.

The following species of *Evania* from Ceylon (where it was taken by Mr. George Lewis) appears to me to be undescribed:

EVANIA CARINIFRONS, n.s.

Black; densely covered with long greyish pubescence; wings hyaline, with a slight trace of a fuscous tinge. Antennae stout, longer than the body, the scape bearing a silvery pile. Vertex covered with large punctures; front densely covered with silvery pile, irregularly longitudinally striated; it is scarcely excavated above the antennae. Face strongly, acutely striated, the striations converging towards the centre; a stout keel down the centre, issuing from between the antennae, and joined a little from its origin by a short keel from each antenna. Mandibles shining and bearing three teeth, in addition

to the large apical one. Prothorax convex in front, produced at each side, so that the head fits into it, and sharply margined. Upper side of thorax coarsely punctured; the sides and metanotum coarsely reticulated, except a smooth, shining space in the centre of the mesopleura. The sternum bears some large punctures, and is deeply and widely furrowed. The furrows on mesonotum wide and curved. Petiole rugose. Abdomen sub-triangular, densely covered with white pubescence. The pobrachial transverse nervure is interstitial and the recurrent nervure is nearly so. The first cubital cellule is about one-fourth longer than broad, narrower at apex than at base; the praebrachial nervure is received near the middle of the cellule. All the nervures are curved; the cubitus is obsolete from the first cubital cellule. Legs densely pilose; claws minutely toothed.

Length, 8 mm.; hind legs, 15 mm.

This species comes nearest to *E. princeps*, West., from Australia, but is much smaller, *princeps* being 7 lines in length.

For the *Hymenoptera* here described I am indebted to Mr. George Lewis, whose investigations into the insect fauna of Japan are so well known and appreciated by entomologists.

TENTHREDINIDAE.

DOLERUS BIMACULATUS, n.s.

Bluish-black; abdomen bluish-green; the two lateral lobes of mesonotum red; abdominal segments (the apical broadly) edged with white. Antennae as long as the abdomen, the apex attenuate; third joint longer than fourth. Head coarsely punctured, vertex without sutures, except two short indistinct furrows behind the ocelli; the centre raised from the sides; face and sides of head covered with long white hair; clypeus projecting, deeply incised. Thorax strongly punctured, the pleurae and sternum rugose, covered

with long white hair; middle lobe of mesonotum triangular at apex; the sutures deep; a deep furrow in the centre of middle lobe; post-scutellum impunctate, shining; cenchri cream-coloured. Abdomen broad, dilated towards the middle, impunctate, covered with a silky pubescence; the ventral surface with long white hair; cerci black. Wings clear hyaline, the apex slightly smoky; stigma and nervures black; transverse radial nervure received a little before the second transverse cubital; transverse median nervure received before the middle of cellule. Legs stout, densely covered with a pale pile; spurs white, short, about one-third of the length of metatarsus; hind tarsi shorter than tibiae; patellae well developed, pale.

Length, 11 mm.

Hab. Nagasaki.

DOLERUS LEWISII, n s.

Bluish-black; the middle lobes of mesonotum coppery, edges of abdominal segments white. Antennae black, covered with a microscopic pile; the third and fourth joints subequal, the former curved and more densely pilose than the other joints; the scape covered with long white hairs. Head coarsely punctured, covered sparsely with long white or pale hairs; the centre of vertex raised, without distinct lateral sutures; a transverse furrow between the two hinder ocelli; clypeus projecting, deeply incised. Thorax punctured, the pleurae and breast more strongly and closely; and covered densely with pale hair; sutures of middle lobe of mesonotum very deep, broad and shining at the apex; furrow in middle lobe narrow; depression at base of scutellum broad, deep, it (as well as the part in front of it) being shining, impunctate; the part at apex of scutellum striated; post-scutellum punctured. Abdomen silky, carinate down the middle; the basal segment obscurely punctured; there is a depression at the apex of the eighth segment where the keel

ends; wings as in the preceding species. Spurs acute, white at the apex; base of metatarsus white.

Length, 8 mm.

Hab. Nagasaki.

ABIA JAPONICA, n.s.

Black; the abdomen at the base dull metallic green, the head with long black hairs, the thorax thickly covered with fulvous hair, basal segment of abdomen bearing longish fulvous hair, the rest with long depressed silky hair, longest and thickest at the apex and at the sides. Head closely punctured, shining, metallic, centre of vertex raised into a pad-like elevation, surrounded behind by a furrow; the lower ocellus is placed in a deep depression, and from this a shallow furrow runs down to near the apex of the pad-like elevation; behind this the vertex is depressed in the centre, through which runs a furrow. Apex of clypeus broadly and roundly incised; labrum longer than it, shining, not metallic, impunctate, the apex rounded. Palpi hairy, the four apical joints dirty yellow. Thorax closely punctured; on the mesonotum the puncturation is nearly hid by the dense covering of hair; on the pleurae the hair is longer, but not so thick, and black in colour. Basal segment of abdomen finely punctured, and with a longitudinal keel down the centre. Legs densely pilose, coxae and femora punctured, black; four hind tibiae and tarsi white, except on the inner side of the apices of the tibiae; fore tarsi obscure fuscous; claws bifid. Wings yellowish-hyaline; a small brownish spot at base of cubital cellule; stigma yellowish, black at base; costa yellowish, except before stigma; transverse radial nervure received before the middle of the second cubital cellule, which is about one-fourth longer than broad, and gradually becomes wider towards the apex. Antennae 7-jointed, the seventh joint longer and thicker than the sixth.

Length, 15 mm.

Allied to *A. nigricornis*, Leach, but easily known from it by the dense fulvous hair on the thorax, by the antennae being distinctly 7-jointed, by the much more deeply incised clypeus, and by the long labrum.

Hab. Nagasaki.

ABIA LEWISII, n.s.

Metallic bluish-green; antennae black; knees, tibiae, and tarsi, stramineous. Head and thorax finely punctured; densely covered with long black hair; abdomen velvety. Vertex not depressed in the centre behind; the portion between the hind ocelli and the antennae raised; the apex rounded and projecting between the antennae. Apex of clypeus transverse, of labrum rounded, impunctate, piceous-black. Antennae 6-jointed, the apices of the joints oblique. Wings hyaline; an obscure fuscous oblique band across the transverse median nervure, extending from the costa to the first recurrent nervure; a deeper and much smaller blotch at the base of the first cubital cellule; the transverse radial nervure received beyond the middle of the second cubital cellule, which is longer than broad, its apex slightly smoky, and its basal nervure with a different slope from the apical, it being oblique. Stigma and costa testaceous, the latter brighter in tint at the base. The femora are covered with longish black hair; tibiae and tarsi with closer and shorter hair; claws simple; femora and coxae greenish-blue in tint.

Length, 12 mm.

Related to *A. mutica*, Thoms.

Hab. Yokohama.

BRACONIDAE.

HELCON CORNUTUS, n.s.

Black; a narrow ring a little beyond the middle of the antennae; the apex of first, and the second to fourth joints of the tarsi, white; the apex of the anterior femora and tibiae in front obscure fuscous. Wings hyaline with a fuscous tinge; the nervures black. Antennae nearly as long as the body, micro-

scopically and closely pilose, stout, the apex involute; the third joint a little shorter than the fourth, the other joints not clearly distinguishable except towards the apex. Head large, cubital slightly projecting behind the eyes; the occiput, vertex, and front shining, except the latter at the sides, which are rather strongly punctured; the face is coarsely rugose. The excavation on the front is deep, and extends upwards so as to enclose the lower ocellus, the triangular prolongation of the depression separating it from the other two, which are placed one on each side of the depression. The mandibles are curved, piceous at the base; there is a small subapical tooth. Palpi thick, longish, pilose. Thorax in front (at the sides and above) coarsely rugose, the depression on the pronotum crenulated; mesonotum and scutellum strongly punctured; the mesopleura has large scattered punctures, and longish scattered hair. The metanotum is coarsely reticulated; the metapleura coarsely punctured. Petiole shining, strongly punctured, the punctures running into reticulations; the centre is raised, the elevation being bounded by two stout keels; along the sides at the base is a furrow of moderate width. The rest of the abdomen is smooth, shining, and impunctate. The abdomen is a little longer than the thorax; it is somewhat narrower than the thorax, is of nearly equal width from the second segment, and laterally at the apex is obliquely truncated. The ovipositor is almost as long as the thorax and abdomen together, and issues from the lower side of the abdomen. The pobrachial transverse nervure is interstitial, the transverse praebrachial is united to the cubitus near its origin; the recurrent nervure is received in front of the first transverse cubital; the second cubital cellule is a little shorter than the first. Legs stout, covered with white hair; the hind coxae and femora punctured strongly, the others scarcely punctured; the hind tibiae are much longer than the tarsi.

Length of body, nearly 12 mm.; of terebra, 11 mm.

Hab. Fukui.

This species, having a blunt tooth on the hind femora, is a *Helcon* as limited by Foerster; but it differs from that genus in having a short horn—flattened laterally and cleft at the apex—immediately over the antennae. The spurs are short and thick, especially the hinder; the claws simple. The eyes are oval and margined.

ICHNEUMONIDES.

AMBLYTELES LUDOVICUS, n.s.

Black; joints 11-14 of antennae on the underside, two large marks on each side of the ocelli touching the eyes, a small mark in the centre of the penultimate segment, and a larger one on the last abdominal segment and the scutellum, white; the anterior knees and tibiae in front obscure white; wings smoky hyaline, stigma black, fuscous in the centre. Antennae stout, involute, as long as the abdomen, covered with a fine pile; basal joint of scape rugosely punctured, covered with longish black hair. Head closely and strongly punctured, the vertex and front not so strongly as the face; covered with a longish fuscous pubescence; eyes with a distinct margin above the base of the antennae. Thorax strongly punctured all over, the punctures running into reticulations and striations on the pleurae; scutellum more shining, and not so strongly punctured; post-scutellum shining, impunctate in the centre, the sides punctured; metathorax with the punctures running into reticulations; there are five basal areae; the supramedian reaching to the extreme base, without any transverse keel; it is dilated in the middle, longer than broad, the sides rounded; the basal lateral area a little longer than broad, its apical keel scarcely oblique; post-median indistinctly divided in three. The metanotum, breast, and pleurae densely covered with dense fuscous hair. Except at the apex the petiole is shining, impunctate; the post-petiole and apex of

petiole strongly punctured; a sharp keel runs along each side of the petiole, and is prolonged to near the centre of the post-petiole; another keel runs along the post-petiole to a little past the spiracle. Abdomen opaque, closely punctured, the apical segments obscurely; covered (especially at the apex) with a dense pile; gastrocoeli transverse, shining, moderately deep. Legs covered with a dense pile, longest on the coxae, which (especially the posterior) are punctured; the spurs incline to piceous. Areolet irregular, the lateral nervures converging at top; the recurrent nervure received in the apical third.

Length, 16 mm.

Hab. Yatsurhiro.

This species comes near to the description (so far as it goes) of *Ichneumon cognatorius*, Sm., but is, so far as I can make out from the description (which makes no mention of the sculpture), distinct.

EXEPHANES JAPONICUS, n.s.

Black; joints 10-14 of antennae above, the trochanters, spurs, and anterior tibiae in front, and three apical joints of abdomen above, white; base of flagellum fuscous beneath. Antennae about as long as the abdomen and half the thorax together, semi-involute, stout, thickened beyond the middle, covered with a microscopic pile; scape scarcely punctured. Head sub-buccate, strongly punctured, except the depression over the antennae, which is shining, impunctate, and carinated in the middle above. Clypeus very slightly sinuated at apex; palpi longish, fuscous at apex; foveae at sides of clypeus small, deep. Thorax closely and strongly punctured; the pleurae and breast densely pilose and more strongly punctured than the mesonotum; scutellum carinate along the sides, shining, punctured; post-scutellum shining, impunctate, the sides with a few longitudinal striations. Metathoracic areae distinct; the supramedian with a keel at the base, and not

reaching to the base of metanotum; 6-angled, longer than broad, the sides angled in the middle; posterior median area reticulated. Abdomen narrower than the thorax; petiole shining, impunctate; sides of post-petiole with some distinctly separated punctures; the middle at base obscurely striated. The rest of abdomen opaque, closely punctured; gastrocoeli transverse, large, wide, moderately deep, finely punctured. Legs pilose, coxae finely punctured. Wings hyaline, with a smoky tinge; stigma black; areolet 5-angled; the lateral nervures converging towards the top; the recurrent nervure received a little beyond the middle.

Length, nearly 12 mm.

Hab. Hakodate.

HOPLISMENUS MIKADO, n.s.

Black; the face, orbits broadly all round, mandibles, except at apex, palpi, a broad line along the pronotum, the tubercle below the tegulae, these at the edges, two lines on mesonotum, scutellum, post-scutellum, a mark at the base of the scutellar keels, petiole (except in the middle), post-petiole, the apical two-thirds of second segment, apical three-fourths of third, the legs (except the base of four front coxae), the hind coxae entirely, apical half of hind femora, apex of hind tibiae and the antennae broadly at the base, yellow; wings yellowish, the apex smoky, costa and stigma yellowish-testaceous. Antennae stout, tapering towards the apex; scape pilose, flagellum almost glabrous; basal joints of flagellum obliquely truncated at apex; apical subdentate. Head strongly punctured; the depressions above antennae shining, impunctate, deep, rounded at top, truncated at apex, separated by a broad punctured band; eyes margined; ocelli surrounded by a narrow but deep furrow, the space between them depressed; face projecting broadly, the projecting part separated from the sides by a deep and wide depression; clypeus more or less blackish at apex. Pro- and

mesothorax opaque, closely punctured; sides of prothorax on lower side strongly striated; scutellum strongly gibbous, obsoletely punctured, pilose; post-scutellum impunctate, the space between the scutellums reticulated. Metathorax very strongly reticulated, gibbose, the centre excavated; there are only four median areae, the supermedian being absent; the posteromedian very strongly reticulated; at its base is a small, shining, impunctate space; the metapleurae are less strongly reticulated than the rest of the metathorax. The prosternum is covered with long yellowish hair, the mesothorax closely pilose; metathorax with the hair longer, but more irregularly distributed. Petiole finely punctured, the sides strongly keeled, the keels reaching to a little before the middle of the post-petiole, which is closely punctured and obscurely striated in the middle at the base. The rest of abdomen opaque, closely punctured; the base of second segment strongly longitudinally striated. Gastrocoeli deep, longer than broad, shining, striated. The suture in the centre of mesosternum is deep, reticulated. Legs densely pilose; coxae strongly punctured. Areolet four-angled, triangular at top, the recurrent nervure received in the centre. There is a longish curved branch on the cubitus.

Length, 30 mm.

Hab. Kobe.

EPIRHYSSA JAPONICA, n.s.

Black; the face, the orbits except at top, a line on pronotum, two marks below the tegulae, the tegulae, two short lines on mesonotum, the scutellum, two small marks (the outer the largest) on each side in front of it, post-scutellum, a line in front of it at the side, two large oblique marks on metanotum nearly joined at top, the apex of petiole, two lines at sides of second to sixth segments, the front legs entirely, the four hinder trochanters, apex of four hind femora, and the tibiae and tarsi, yellow. Wings hyaline, a smoky

band at the apex of front pair; stigma testaceous. Antennae fuscous, longer than the abdomen; microscopically pilose, the basal joints of flagellum obliquely truncated at the apex; the last joint is as long as the preceding two together. Head punctured, the depressed space above the antennae strongly striated; a black mark in the middle of face; sides of clypeus blackish; the apex slightly incised, projecting; palpi yellow; mandibles black, broad, the apex incised. Head pilose, longest on the face. The transverse striations on mesonotum strong, close; scutellum transversely reticulated, striated, flat; post-scutellum shining, impunctate; metanotum punctured; a deep furrow in the basal half in the centre; prothorax shining, impunctate; mesopleurae shining, punctured; mesosternum opaque, closely punctured. Abdomen shining, impunctate, glabrous above; the apex of second segment piceous. Terebra 2½ times the length of body, fuscous, the apex piceous. Coxae at base punctured; coxae, trochanters, and femora covered with long yellow hairs; tibiae and tarsi with a close pile. Anterior tarsi nearly three times the length of tibiae.

Length, 23 mm.

Hab. Hakodate.

The occurrence of *Epirhyssa* in the Old World is of much interest, the recorded species being from Cuba and Central America. It has the transversely striated mesonotum of *Rhyssa*, but wants the areolet.

XXVII.

A NEW SPECIES OF ALLANTUS (A. breviventris, sp.n.) FROM SALONICA.

BY P. CAMERON.

[Read 29th December, 1885.]

ALLANTUS BREVIVENTRIS, sp. n.

Black; the scape, labrum, clypeus, tegulae, a short narrow line on the pronotum, the legs, and segments 3-5 of the abdomen (except a mark on each on the ventral surface), fulvous, the mouth and tibiae almost yellow. The four anterior femora bear a black line behind, the apical half of the tibiae and the tarsi being also black behind; the apex of the middle tibiae, and the tarsi, from the apex of the basal joint, the apex of the hind tibiae, and the tarsi from the apex of the basal joint all round, black. Wings smoky, the stigma fulvous above, fuscous on lower side. The second cubital cellule is, on the upper side, longer than the third on the upper side, but, on the lower side, is a little shorter than the lower side of the third. The first recurrent nervure is received a little in front of the middle of the cellule, the second in the basal third of the third cellule; the transverse basal nervure before the middle of the cellule. The body is short and broad, the abdomen being not much longer than the head and thorax together. Antennae not much longer than the thorax, moderately stout, covered with microscopic pile; the third joint is more than double the length of the fourth. Head as broad as the mesothorax, retreating slightly behind the eyes, which converge in front towards the antennae. Clypeus broadly, roundly, and deeply incised. The frontal area extends from behind the front ocellus to near the

antennae, is broad at base, narrowed from the middle, and deep; the lateral furrows on the vertex are deep, if not very wide; the transverse one behind the ocelli is narrow. Palpi fuscous (perhaps discoloured). Sutures of the mesonotum wide and deep; there is a wide and deep depression in the centre of the fore lobe, which bears a few punctures. Cenchri white. Legs moderate, the spurs thick, about one-third of the length of the metatarsus; patellae large, stout; claws bifid. The four posterior femora are deeply and broadly hollowed on the under side; the fore pair narrowly, close to the edge, the groove giving the edge the appearance of being margined.

Length, 9 mm.; wing stretch, 20 mm.

The short, thick body, short abdomen, long wings, and short, thick spurs (which are shorter than usual, the spurs with most of the species reaching to the middle of the metatarsus), make this a very distinct species.

Taken at Salonica, by Mr. J. J. Walker, R.N.

XXVIII.

NOTES ON THE LAND AND FRESH-WATER MOLLUSCA OF GREENOCK AND SURROUNDING DISTRICT.

BY THOMAS SCOTT.

[Read 29th December, 1885.]

NINE years ago, when the British Association held its meetings in Glasgow (in 1876), a number of very useful lists of species belonging to various groups, both of animals and plants, were prepared; and these form no inconsiderable part of the *Fauna and Flora of the West of Scotland*, a book which is very useful to all students of Natural History for reference. Among these lists is one of the Land and Fresh-water Mollusca, which includes all the species known to its compiler as occurring in the West of Scotland at that time.

Through the zeal and energy of various workers, our knowledge of the Natural History of the West of Scotland has been considerably increased during these nine years; and one of the branches which have to some extent been successfully worked up is that of the Land and Fresh-water Mollusca. Not only have new stations been found for the species already known to occur, but several species and varieties have been added to the list of those previously recorded; and no doubt, as the study of this branch becomes more widely and thoroughly carried out, other additions will yet be made. Accordingly, with the progress made in other branches of Natural History, it will possibly be found that ere long the second edition of the *Fauna and Flora*, referred to in the preface to the first, will be much needed; and it is to be hoped that this will by-and-by be an accomplished fact. Not only will a

second edition be useful—as the first has been and still is—for ascertaining the number of species and their local habitats; but it will also be of great value for showing how much our knowledge, especially of the local and general distribution of species belonging to the different groups, has been increased within a definite period.

Having devoted part of my leisure, during the past year or two, to the working out of the distribution of the Land and Fresh-water Mollusca about Greenock, as well as in a few places beyond but within easy access of that town, perhaps the result of these researches, embodied in the following Notes and List, may form a contribution—though possibly not a very important one—to the second edition of the *Fauna and Flora* referred to.

Those who are studying this group of the Mollusca will doubtless have noticed a growing tendency among conchologists to be more and more discriminating. Differences in banding and coloration, as well as in form, which used to be only incidentally referred to in the description of the species, are being more and more separated and raised to varietal or sub-varietal rank; and considering the exceeding variableness of many species, it becomes to some extent interesting to note the number and distribution of the different varieties. This critical study of the variations in different species may, if judiciously carried out, be of considerable importance in increasing our knowledge of the relationship of species; but whether the variation in the colour and number of bands of the shells of such species as *Helix nemoralis* and *H. hortensis* deserves all the attention it is receiving, I will not venture to say. I think, however, that these variations may be regarded as at least worthy of some study by those who have time to devote to it. The local distribution of some of these colour-varieties is rather interesting. By the side of the branch line connecting the quarries in Shielhill Glen with the Wemyss Bay Railway, I

find a variety of *Helix nemoralis* with the shell slightly smaller than usual, semitransparent, and of a greenish-yellow colour; but after the animal has been killed the shell becomes opaque and of a more decided yellow colour. This variety—the only one I have noticed at that place—I do not find anywhere else in the district. At the "Moat-hill," Cupar-Fife, I got an almost black variety of the same species. At that place most of the shells are of a blackish colour; but nowhere else in the neighbourhood did I find them so dark, though I have got them of a somewhat similar colour on the Castle-rock, Edinburgh. Again, at a place near Kenmore, Perthshire, I gathered some specimens of the same species, of a yellow ground-colour, with dark brown bands; but in adult specimens these bands became broken up and diffused over the ground-colour just before reaching the lip, thus producing a rather pleasing effect. This peculiar band-dispersion was not observed in specimens gathered from any other place in that locality. Accordingly, when variations, though only in colour, are met with, and appear to be strictly local, as in these examples, the reason for such restriction forms a subject of enquiry at once interesting and important.

It will be seen from the List, which has been prepared for me by my son Andrew, that the aquatic species are but poorly represented in our district. With perhaps one or two exceptions, all those recorded are comparatively common, the reason being that there are few places suitable for the propagation of aquatic molluscs. One of the exceptions I have mentioned is *Pisidium nitidum*. I find this species—along with other two interesting things, viz.: *Candona euplectella* (an ostracode) and *Utricularia minor* (a bladderwort)—in some pools by the side of the road leading from Port-Glasgow to Kilmalcolm. These pools occur in a natural hollow through which the road passes, and are probably all that remain of what was once a considerable

though shallow loch. If that be the case, then this *Pisidium* and its neighbours in these pools may be the descendants of ancestors dating back to a "remote and venerable antiquity," and not comparatively recent introductions, as some species undoubtedly are. A year or two ago I introduced *Sphærium corneum*, *Bythinia tentaculata*, and *Limnæa stagnalis*, into a dam near Greenock; but by the following year they all appeared to have died out, as no trace could be seen of any of them. Though aquatic species be so few about Greenock and the neighbouring districts, there are a good many terrestrial molluscs; and my son and I have been able to add not only new stations for some of the rarer species recorded in the list of 1876, but also a few species and varieties not included therein. The species and varieties added are *Amalia marginata*, *Limax flavus*, *Zonites alliarius* var. *viridula*, *Helix aspersa* var. *scalariforme*, *H. arbustorum* vars. *alpestris* and *flavescens*, *H. rufescens* var. *alba*, *H. caperata* var. *major*, *H. rotundata* vars. *pyramidalis* and *alba*, *Pupa umbilicata* vars. *edentula* and *albina*, *Vertigo pygmæa* var. *pallida*, *V. substriata*, and *Clausilia rugosa* monst. *decollatum* (?). This form of *Clausilia rugosa* was found on a wall by the side of the Inverkip road about four miles from Greenock. My son and I picked up a good number of living specimens; but these were not all exactly alike, some having lost more and some less of the apical end of the shell. We could not arrive at any conclusion as to the reason why the shells were thus broken; but whatever may have been the cause the animals appeared to be uninjured, as they were as lively as any of those possessing whole shells. We also got a specimen which either had had its shell broken and the broken part attached again—but in an awkward position, being nearly at right angles—or else the end was in process of being broken off. In all the damaged specimens found, we did not see one that had the broken end soldered up, as is

observed in truly decollated shells, such as *Bulimus decollatus*. Possibly, however, we may have come on them too soon for that to have taken place; or perhaps the closing up of the broken end would be an after consideration, especially if it were found that there was some danger of an attack being made on the animal from behind; or perhaps it was a "new departure"—an experiment as to the economising of space in order to lighten as much as possible the burden that had to be carried, so that the "struggle for existence" might be engaged in with a greater likelihood of success;—but the working out of these abstruse questions I leave to those with more subtile intellects.

Among the rarer species, for which new stations are recorded, is *Acme lineata*, which my son found near the Cloch in 1881. In the following year he found another specimen about the same place, but it was partially crushed. Of the species and varieties mentioned in the annexed List, the only form which I do not possess or have not seen is *Zonites purus* var. *margaritacea*, for which, in the 1876 list, the Cloch is given as a habitat.

I have to acknowledge my obligation to the late Dr. Gwyn Jeffreys for his kindness in identifying a few of the rarer and more critical species mentioned in this List.

The arrangement of the *Conchological Society's List of British Land and Fresh-water Mollusca* (1883) has been generally followed.

List of Land and Fresh-water Mollusca of Greenock and surrounding District.

CONCHIFERA.

SPHÆRIIDÆ.

PISIDIUM FONTINALE (Drap.), var. PULCHELLA, Jenyns.—Mossclave pond, near Greenock.

PUSILLUM (Gmel.).—Mossclave pond, and other places.

NITIDUM, Jenyns.—Pools, side of Kilmalcolm road, near Port-Glasgow.

UNIONIDÆ.

UNIO MARGARITIFER (L.).—River Gryfe at Denniston, Kilmalcolm.—*Thomson-Denniston.*

GASTEROPODA.

Aquatic.

LIMNÆIDÆ.

PLANORBIS SPIRORBIS, Mull.—In pools, Garvel Park, Greenock; Kilmalcolm road. Near Inverkip. —*Binnie.*

PHYSA FONTINALIS (L.).—Cemetery pond, Greenock (probably introduced).

LIMNÆA PEREGRA (Mull.).—Various places about Greenock.

var. OVATA, Drap.—Filter dam, Greenock.

PALUSTRIS (Mull.).—Pools, side of Kilmalcolm road, near Port-Glasgow.

TRUNCATULA (Mull.).—Various places about Greenock.

ANCYLUS FLUVIATILIS, Mull.—Various places about Greenock.

Terrestrial.

ARIONIDÆ.

ARION ATER (L.).—Common.

HORTENSIS, Fer.—Frequent; Shielhill Glen, Kilmalcolm, &c.

LIMACIDÆ.

AMALIA MARGINATA (Mull.). — Frequent in gardens about Greenock.

LIMAX MAXIMUS, L.—Frequent.

FLAVUS, L.—Rare about Greenock.

AGRESTIS, L.—Too common.

LÆVIS, Mull.—Frequent; Shielhill Glen, and other places.

ARBORUM, B.-Ch.—Cloch, and other places.

HELICIDÆ.

SUCCINEA PUTRIS (L.).—Cloch, and other places.

VITRINA PELLUCIDA, Mull.—Frequent about Greenock.

ZONITES CELLARIUS (Mull.).—Common.

ALLIARIUS (Miller).—Cloch, and other places.

var. VIRIDULA, Jeff.—Cloch (1885).

NITIDULUS (Drap.).—Common.

PURUS (Alder).—Shielhill Glen.

var. MARGARITACEA, Jeff.—Cloch.—*Binnie.*

RADIATULUS (Alder).—Cloch and Shielhill Glen.

EXCAVATUS (Bean).—Cloch and Shielhill Glen.

CRYSTALLINUS (Mull.).—Frequent about Greenock.

FULVUS (Mull.).—Various places.

HELIX LAMELLATA, Jeff.—Cloch (1881).—*Andrew Scott.*

ACULEATA, Mull.—Cloch, frequent.

ASPERSA, Mull.—Common about Greenock.
monst. SCALARIFORME, Tayl.—Old wall, Crawford Street, Greenock (1885).
NEMORALIS, L.—Common. Variously banded and marked.
HORTENSIS, Mull. — "Scott's Glen," Greenock. — *Thomas Fisher, Greenock.*
ARBUSTORUM, L.—Frequent about Greenock.
var. ALPESTRIS, Ziegl.—Shielhill Glen.
var. FLAVESCENS, Moq.—Shielhill Glen.
RUFESCENS, Penn.—Locally common about Greenock.
var. ALBA, Moq.—Side of wall, Madeira Street, Greenock
HISPIDA, L.—Frequent about Greenock.
SERICEA, Mull.—Towerhill, Gourock, and Wemyss Bay.
FUSCA, Mont.—Shielhill Glen and Wemyss Bay.
CAPERATA, Mont.—Wemyss Bay.
var. MAJOR, Jeff.—Wemyss Bay.
ROTUNDATA, Mull.—Common.
var. PYRAMIDALIS, Jeff.—Shielhill Glen (1884).
var. ALBA, Moq.—Cloch and Shielhill Glen.

PUPA RINGENS, Jeff.—Rottenburn and Shielhill Glens.
var. PALLIDA, Jeff.—Rottenburn Glen and Cloch.
UMBILICATA, Drap.—Common.
var. EDENTULA, Moq.—Shielhill Glen.
var. ALBINA, Moq.—Shielhill Glen.

VERTIGO PYGMÆA (Drap.).—Shielhill and Rottenburn Glens.
var. PALLIDA, Jeff.—Rottenburn Glen.
SUBSTRIATA (Jeff.).—Rottenburn Glen.
EDENTULA (Drap.).—Shielhill Glen.

BALEA PERVERSA (L.).—Wemyss Bay.

CLAUSILIA RUGOSA (Drap.).—Shielhill Glen, Cloch, &c., frequent.
monst. DECOLLATUM?—On a wall on the Inverkip road, about four miles from Greenock (1885).

COCHLICOPA LUBRICA (Mull.).—Common.
var. ?—Cloch (1885).

CARYCHIUM MINIMUM, Mull.—Common.

ACME LINEATA (Drap.).—Cloch (1881).—*Andrew Scott.*

XXIX.

NOTES ON SOME ALPINE PLANTS FROM FORFARSHIRE AND ABERDEENSHIRE.

BY PETER EWING.

[Read 23rd February, 1886.]

THLASPI ALPESTRE, Linn., has been divided into the following varieties: — (A) *sylvestre*, Jord. — Raceme long, style not longer than notch; (B) *occitanum*, Jord.—Raceme oblong, style longer than notch, pod triangular; (C) *virens*, Jord.—Raceme oval, style much longer than notch, pod oboval.

This plant grows in several of the mountainous districts of England and Wales; and how the var. *sylvestre* has become established in the Canlochan rocks, when neither it nor any of the other forms is reported from any other part of Scotland, is a question of considerable interest. It is sparingly distributed all over the rocks in Canlochan, growing in solitary plants. I did not observe it at Canness or elsewhere in the district. This is one of the few Forfarshire plants of which, so far as I can find, no mention is made by Don.

From an examination of Canlochan specimens, I would almost have been inclined to refer them to var. *virens*; but all the Floras state that only var. *sylvestre* is to be found at the head of Glen Isla.

SAXIFRAGA RIVULARIS, Linn. This plant was, I believe, first recorded by Don from the Clova mountains; but the district included by him under that name seems to have embraced not only the mountainous part of Forfarshire (in which Clova is situated), but a portion of the adjacent county of Aberdeen. I can find no record of the plant having

ever been found in Clova; and I think Don must doubtless have meant Lochnagar, as he obviously does with reference to some other plants recorded by him from that district.

I do not know if *S. rivularis* is still to be found near the top of Ben Nevis; but a few plants of it still grow on Ben Lawers. Any one, who has seen this plant growing on Lochnagar, would very readily form the impression that it had been planted on Ben Lawers and had never become fully acclimatized. On the latter mountain the plants appear small and weak, seldom exceeding $2\frac{1}{2}$ inches in size; while, on the former, they are much more luxuriant, their average size being about 4 inches.

GNAPHALIUM NORVEGICUM, Jacq. This plant is recorded from a good many stations, and it is said to be found chiefly on the mountains once covered by the Caledonian forest. I have botanized over a considerable area of mountainous country said to have been once covered by that forest, but have not met with anything resembling the plant. A stunted form of *G. sylvaticum* is pretty common on our Highland mountains, and its general description seems in most respects to agree with that of *G. norvegicum*; but, when specimens are compared, their difference is at once seen to be very marked. Canlochan is given as one of the stations for this plant. I have, I think, examined nearly all the rocks that can possibly be reached without a rope; but while I have frequently observed the alpine form of *G. sylvaticum*, I have not as yet seen anything approaching *G. norvegicum*. It grows, however, beside the *Mulgedium alpinum* on Lochnagar.

MULGEDIUM ALPINUM, Less. In the mountainous districts of Forfar and Aberdeen this plant does not seem to be so rare as many of our more widely distributed alpine species. In Canlochan there are five patches, three of which are known to me; one in Canness, known to Dr. Stirton; two in Corrie

Ceandor; and one at least in Lochnagar, consisting of about 150 plants. It can neither be said to be found "on high wet rocks" nor "beside rivulets," as is stated in some of the Floras. According to my experience, I have in all cases found it in those situations, well-known to alpine collectors, where *Lychnis diurna*, *Geranium sylvaticum*, and *Luzula sylvatica* seem to find a congenial home—moist sheltered places at an altitude of about 3,000 feet. I believe the chief cause of the "rarity" of this plant to be the difficulty of reaching the spots where it grows. I do not believe one collector in a hundred would undertake to gather a single specimen from any of the stations where I have seen it. In appearance it much resembles *Sonchus oleraceus* but with blue flowers.

EPIPACTIS OVALIS, Bab. This seems to be an English subspecies of the rather common *E. latifolia*. Sutherlandshire was, I believe, the only Scotch county in which this plant had been found before it was gathered by Rev. J. Fergusson and myself last summer. We were working round some limestone rocks towards a spot where Mr. Fergusson had seen two or three plants a day or two previously, when I came on a good many. As these were not yet in flower, and we were tired after our day's work, we did not go nearly so far round as the station indicated by Mr. Fergusson. It seems strange that while Don should have found in this district so many plants which no one else has rediscovered, this species and *Pyrola secunda* should only last year have been added to the botanical record of the county.

CAREX LAGOPINA, Wahl. This is doubtless the rarest of the British *Carices*. It seems to have been overlooked by Don, and up till now has only been reported from Lochnagar and Cairntoul; but having found a specimen in Canlochan, I am enabled to add another to its list of stations. The specimen referred to was

found growing among *Carex vaginata* on a ledge at an altitude of about 2,700 feet.

I would advise collectors to deal carefully with all *Carices* found growing in alpine situations, especially such as have either a single spikelet or several spikelets crowded together.

ALOPECURUS ALPINUS, Linn., var. WATSONI. The typical form is by no means rare in the Clova district; it grows in almost every rill from 1,500 feet upwards. At an altitude of about 3,000 feet, the var. *Watsoni* begins to appear, growing along with the type. In this variety the awns are no doubt much longer, and the glumes more acute, than in the type; but there are intermediate forms which seem due to the external conditions of the plant. For my own part, I do not consider this variety worthy of separate distinction, and Don seems also to have disregarded it.

LYCOPODIUM ANNOTINUM, Linn. This, the rarest of British *Lycopodiaceæ*, is common enough both in the Clova district and the North-east of Perthshire, although I do not remember having seen it on the Breadalbane mountains.

XXX.

JOTTINGS FROM MY NOTE-BOOK.

BY DAVID ROBERTSON, F.L.S., F.G.S.

PAGURUS PRIDEAUXII, *Leach.*

[Read 9th June, 1885.]

This crab is well-known for its constant association with the Hydrozoon *Adamsia palliata.*

Many years ago, while observing some fishermen lifting their nets on Lochfyne, I noticed that in several places in the nets there were two of these crabs together, each couple consisting of a larger and a smaller individual. It occurred to me afterwards that they might be male and female, but I neglected the opportunity of examining them at the time. When dredging I often afterwards met with males and females; but as the dredge had raked over a considerable part of the sea-bottom, I could not say that they had been taken together.

Some time afterwards, during a very low tide, a favourable opportunity occurred of seeing at different places three pairs—male and female—together. I am therefore strongly led to suspect that they pair, and that they probably prove true to each other. If so, we may presume that the weaker shares the protection of the powerful pincers of the stronger sex.

AMPHIDOTUS CORDATUS, *Penn.*

[Read 26th January, 1886.]

The source of the mucus thrown out by this animal under irritation has long been a puzzle; and, so far as I know, it still remains so. In the

following remarks I will try, as briefly as possible, to narrow the question.

A very interesting paper by Mr. W. P. Sladen shows that in a Mediterranean species of the same genus the slime is secreted in sacs belonging to the pedicellariæ, but no such sacs or secretions have as yet been recorded in connection with the pedicellariæ of any British species.

This Sea-Urchin is common all round our shores. It burrows in the sand to a depth of five or six inches, and keeps a small free opening from itself to the surface, through which pass long processes in search of food. The first thing that is noticed, when one of these Urchins is dug out of the sand, is how clean it is. The spines are all smooth and free from impurities; not a particle of the running wet sand in which they are imbedded is to be seen among them.

By a series of experiments I found that the animal has the power of throwing out a large quantity of mucus to relieve itself of any offensive matter that might assail it. In this way it is able to protect itself from the intrusion of the sand; and in all likelihood, by the same secretion, it keeps open the small passage between itself and the surface.

To endeavour to find the source of the secretion, one of the above species, newly taken from the sand, was put into spirits. When immersed the spines made no motion, but soon became greenish; nor was the spirits in any way altered beyond being tinged by a little colour extracted from the animal. By this treatment no mucus was thrown out. Another was put into fresh water; and in a short time mucus was thrown out copiously, quite covering the spines. Its quantity appeared to be nearly equal to the amount of water usually contained in the animal. Suspecting that there might be some conversion of fluids, I drew the water from the shell or test of one of the animals, and put it into two clear glass phials. The water thus taken was a little whitish.

To one of the phials was added one-third of rain-water, but no immediate change was perceptible. After the mixture had stood for a little, however, it became clearer, with a thin stalk of mucus standing up the middle, and tinged towards the base with a brownish red deposit that had subsided. In a few hours the base of the stalk had spread into a dark mass.

At the end of two days the unmixed fluid taken from the same test still retained its whitish appearance.

The empty test was put into fresh water, and in a short time a good deal of mucus was found on the outside among the spines. Thinking it possible that the mucus might be derived from water not fully drawn from the test, and to make sure that nothing was left within before the fresh water touched it, I took out the whole of the viscera and washed the inside of the test clean with sea-water. It was then put into fresh water, where in a short time it threw out mucus copiously. From other experiments of the same kind, attended with the same results, it appeared that the source of the mucus did not exist within the walls of the shell. I now repeated experiments that I had formerly made of removing all the spines from the outside. In this case I first cleaned off the spines with my knife; and lest any of the minute ones or other organism might be left, I rubbed the test all over with sand, cleaning out thoroughly all the furrows. It was then immersed in fresh water, but no mucus was produced, showing that the origin of that matter was not to be looked for in the test. With a view to find where the mucus issued from, I cleared off a circle of spines, leaving a patch of them on one side of the test, and placed the test in a tea-cup in such a position that when the cup was filled with fresh water the patch of spines would just be covered. By this method, with a good light thrown on the side from which the spines projected, I could see them clearly

from top to base. No movement of fluids could be detected, but in a short time it was found that the spines were immersed in mucus, mostly at the top. From the above facts I am strongly inclined to believe that the seat of the mucus is at the base of the spines. I hope shortly to be able to bring before you the results of a few other experiments on the same subject.

SCAPHANDER LIGNARIUS, *Linn.*

[Read 30th March, 1886.]

Although this mollusc may sometimes burrow to some extent; yet, from the character of the animal remains found in its gizzard, it must frequently be on the surface, particularly as it is commonly taken in the dredge. As its whole body is generally much reflexed over the exterior of the shell, it seems hopelessly exposed to the attacks of its enemies, being destitute of sufficient power of motion to facilitate its escape, and appearing to have no other compensating weapon of defence. It has a shell, it is true; but one would think that it is more obviously of use for spreading its white body upon, than for any protection thereby afforded to the mollusc against proving a lure for the first passing cod. The wonder is how a single one of such a tempting-looking bait is left by the hosts of marauding fishes that swarm over the bottom of the sea. Although fishes are no doubt rapacious enough; yet they have likings of their own that are well known to those who cater to their taste, and we may assume that the reward of those caterers is in proportion to their skill. They must not only know what will generally please each individual fish, but what will be most acceptable at certain seasons, modifying the entertainment for each day according to the particular state of the weather. The sportsman's book of flies is quite a museum of appetising allurements that would tax the skill of the arch-cook of Canterbury better to

please the eye. We may therefore infer that in fishes the delicate sense of taste and flavour is not wanting. We may excuse them for biting at a metal frog or leaping at a tinsel fly, for there they are misled by appearance — a deception that can only be practised while the lure is in motion and is darted at without a moment's time for scrutiny. Seeing that fishes do make a choice of food—and doubtless they have the means of regulating that choice,—may it not be assumed as probable that some unpalatable flavour possessed by the mollusc is its chief means of defence?

XXXI.

BIOLOGICAL NOTES.

BY P. CAMERON.

[Read 24th November, 1885.]

I. ON SOME MITE-GALLS.

1. On *Pyrus Aria.*—Mr. D. A. Boyd has sent me from Glen Lyon some leaves of *Pyrus Aria*, Sm., more or less crowded with the galls of a *Phytopus*. They are visible on both sides of the leaf, forming, on the upper side, irregular white blotches; but are not so conspicuous on the lower, owing to its white colour. They do not project much; in size they vary from 1 to 2½ mm. As has just been mentioned, their colour is, as a rule, white; but, on the top, the centre of the gall (or rather, the border of the depression) may be red, or more rarely the whole surface may assume a reddish hue. On the upper side there is a depression or hole in the centre of the gall when ripe; and it is covered with longish white hairs, more especially on the lower side. Similar blister-like interlacing galls are not uncommon on *Pyrus Aucuparia*; but the only record I can find of the occurrence of mite-galls on *P. Aria* is a notice by Prof. Trail, who records them from near Aberdeen.*

2. On *Artemisia vulgaris.*—Near Cambuslang I found on the upper side of the leaves of this plant small mite-galls. They are projecting, and are, on the average, about 1 mm. in length by about half a mm. in diameter. The surface is marked with small irregular projecting points, and covered with short white hair, which is much longer at the base of the galls. At first these are green, but become reddish or brownish with age; and when old, too, they get bent.

* *Scottish Naturalist*, iv. 168.

What is perhaps the same gall forms a roundish projection about 1 mm. in diameter, but on the upper side of the leaf scarcely measuring so much; and it differs also from the other gall in being densely covered with white longish woolly hair. These two galls are only found on the upper side of the leaf, and do not project or are visible at all on the lower; but there is a third gall which takes the form of a small projecting pustule on the lower side, appearing also on the upper but not projecting there much above the surface. On the lower side it is covered with hair, and is white above and beneath. In Cheshire I find these galls are common, if local.

Phytopus-galls on *Artemisia campestris*, L., and *A. pontica*, L., have been described from Austria by Dr. F. Löw, cf. *Verh. z.-b. Ges. Wien*, 1879, p. 716; and in the same publication (1878, p. 132, pl. ii. f. 5) he describes and figures mite-galls which are no doubt identical with those I have found. Löw's specimens were found by Mayr near Vienna, and have not, so far as I know, been recorded from any other locality on the Continent. The second and third of my galls Löw has not seen.

3. On *Sedum Rhodiola (Rhodiola rosea*, L.).—On the Scuir of Eigg I found abundantly, and on all parts of the plant, the mite-galls described by F. Löw in *Verh. der K.K., z.-b. Ges. Wien*, 1881, p. 5. They are irregular fleshy swellings of from 1-3 mm. in length, mostly yellowish-green, but not unfrequently of a reddish hue, and have in the centre an irregularly sided cavity in which the mites live. Their form is very irregular; the surface is also rough and irregular; and no part of the plant escapes them. Löw's specimens were from Lower Austria, and I am not aware that they have been recorded from any other locality.

II. ON GALLS OF *CECIDOMYIÆ*.

1. *Lasioptera juniperina*.—On the Scuir of Eigg I found galls of this species on *Juniperus nana*, not in

any way differing from those which occur on *J. communis*.

2. Galls on *Rosa spinosissima*.—On the Ayrshire coast I have found the stems (usually near the top) distorted and enlarged by what is no doubt a species of *Cecidomyia*. The swellings vary in length and thickness; some being nearly two inches long, others not more than one-quarter of an inch; while in thickness they vary from two to five lines, being as a rule thicker at the ends than in the middle, when their length is over half an inch. When the galls are of some length they cause the twig to become bent, and it is very seldom that the swellings themselves are not twisted to a greater or less extent. Internally they are woody, but not very firm in texture; and the larvæ do not live in clearly-defined cells. The larvæ are orange, and of the usual *Cecidomyia* form. I have unfortunately not been able to rear them to the imago state, and consequently I am not in a position to say what species may form the galls; nor have I been able to find any record of these galls being described anywhere. They are to be found usually in near proximity to the galls of *Rhodites spinosissimæ*.

3. An undescribed (?) gall on *Lathyrus macrorrhizus*.—Mr. Peter Ewing gave me from the neighbourhood of Kinghorn, Fifeshire, a gall on *Lathyrus macrorrhizus* which I cannot find described. It is an irregular swelling, bent in the middle, having a length of from 7 to 8 lines, and a breadth of from 4 to 5 lines. The outer surface is irregular and somewhat darker in colour than the stem of the plant. Internally it is hard and woody. When I received the gall it was too young, and did not yet contain a grown larva. It is not unlike some of the galls of *Aulax hieracii* found at the roots of the *Hieracia*; and I am inclined to believe that an *Aulax* may be the maker.

III. ABUNDANCE OF THE GALLS OF *NEUROTERUS* IN 1884.

All over Clydesdale during the autumn of 1884 the galls of *Neuroterus* were excessively abundant—especially those of *N. baccarum (lenticularis)*. In many localities the roads were covered with them, while in other places they were heaped up by the wind into piles. Many leaves were entirely covered with them, not a part being left without a gall. On the other hand, in those places where *N. lenticularis* was especially abundant, the galls of *Neuroterus ostreus* and of *Biorhiza renum* were conspicuous by their absence, or by their extreme rarity. As the spring forms of these two species were as abundant as usual, I can only account for their scarcity in the autumnal brood by the fact of their being crushed out by the commoner *N. lenticularis* occupying the leaves so much, and thus not leaving any room for the galls of the species just mentioned to reach maturity—the commoner species, in fact, pushing them out. If this is the correct explanation, then we have here a good instance of how species may become scarce, if not extinguished. It would be of interest to know if the spring forms of *N. ostreus* and *B. renum* were scarce in 1885.

IV. ON FUNGOID GALLS.

On some plants certain fungi form structures which, so far at least as outward resemblance goes, have every appearance of being true galls. Of these I have met with three kinds in the West of Scotland, which, I think, are worthy of notice:

1. On *Rhododendron ferrugineum*.—The fungoid galls on this plant are found on the leaves, have a long diameter of from 3 to 6 lines, are irregular in shape (usually irregularly oval), smooth and reddish externally, internally whitish and spongy in texture. I have only found myself one gall on each leaf. This gall has been described by Albert Müller (*Gard. Chron.*, July 29th, 1871) as the work of an insect,

presumedly a species of saw-fly; and he speaks of the white central part of the gall "enveloping a solitary egg, and that subsequently, when this hatches, the larva begins to feed on the surrounding matter, thus gradually forming a chamber round itself." This, however, is mere imagination, and an examination of some fresh galls has convinced me that the structures owe their origin to an *Exobasidium*. I have found the galls near Dumfries, and they have also been recorded from Colvend and Aboyne; cf. Trail, *Scot. Nat.* ii. p. 251. They have likewise been recorded from Switzerland.

2. On *Juncus*.—The gall-like tumours on the roots of *Juncus*, recorded as British for the first time by Prof. Trail in *Scot. Nat.* i. (New Series), p. 241, I have found on Clober Moor and near Thornhill. My specimens were on *Juncus squarrosus*, L., and *J. uliginosus*, L. Trail discovered his on *J. bufonius*, and Prof. Balfour found them near Glasgow on what was probably *J. lamprocarpus*. These tumours owe their origin to *Entorrhiza cypericola*, Weber. Almost identical tumours I have seen near the Brother Loch on *Eriophorum vaginatum* on the stem quite close to the roots.

3. On *Ruppia maritima*, var. *rostellata*. — For these galls I am indebted to Mr. D. A. Boyd, who discovered them on the shore near West Kilbride. They are pea-shaped (or rather potato-shaped), but rather irregular in shape, have a diameter of from 2 to $3\frac{1}{2}$ lines, are greenish or yellowish in colour, but when mature become brownish. They are parenchymatous, and dark brown in the centre, with a more or less clearly defined cortical layer, which is much lighter in tint, probably owing to the large number of intercellular spaces. The spores are in fours, have colourless membranes, and are situated in the cells of the inner portion.

The species was only described last year by Herr Goebel, who found it on *Ruppia rostellata*, and has

been named by him *Tetramyxa parasitica*. He refers it to the *Myxomycetes*, from the known genera of which it is to be recognised by the spores being formed by quadripartition. The tubers are very likely originated by zoospores being formed on the germination of the spores, the zoospores then penetrating into the tissue of the plant and producing hypertrophy of the tissue. I cannot find that the species had ever been found in Britain before Mr. Boyd discovered it, so it is to be regarded as a highly interesting addition to our flora.

V. ON AN ABNORMAL FEMALE OF *ACILIUS FASCIATUS*.

In looking over my note-book I find the following observations made in 1876: "On 27th May, found in Possil Marsh a female *Acilius fasciatus* with the elytra smooth—as in the male—and almost glabrous, otherwise agreeing with the normal female." I have no reason to doubt the correctness of the above note. Similar instances of female *Dytiscus* appearing with smooth wing-cases have been recorded; and I have seen them quoted as examples of dimorphism, but to my mind the phenomenon is to be explained by atavism — reversion to an earlier condition when both sexes had smooth elytra.

VI. THE HOT-HOUSE THRIPS, *HELIOTHRIPS ADONIDUM*, HAL.

This destructive pest is found in our hot-houses on all plants, feeding on the flowers as well as on the leaves. It occurs often on vines, the leaves of which it causes to become blotched and spotted, and ultimately sucks all the substance out of them, so that the plant dies. The eggs are laid on the under side of the leaf; the larva is white or yellowish, the colour of the abdomen varying with the amount of food in it. Haliday describes the abdomen in the imago as reddish only at the tip, and this no doubt is the case with most of the specimens;

but I wish to point out that the abdomen is not unfrequently entirely reddish. Out of a large number of specimens examined, I have not been able to find a single male. It seems to me that this is the same species as that called on the Continent *Heliothrips hæmorrhoidalis.*

As for the destruction of this pest, I would point out that they are most readily killed in the larval state, when they are easily destroyed by pulling the leaf between the fingers with some pressure. This is certainly the best plan with the more delicate plants, such as the more fragile ferns, and if this be done regularly it will not take long to sensibly diminish the number of the insects.

VII. A WHITE ABERRATION OF *GAMMARUS PULEX.*

In a mountain tarn in Mull I found the common fresh-water shrimp very common, but they differed from all the specimens I have seen of this species in being pure, almost transparent, white. What may be the cause of the whiteness I am unable to explain. The lochan is very deep and stony all round, except at one corner. The shrimp was very common, and all I saw were of the same colour. The other inhabitants of the lochan were *Dytiscus lapponicus*, some other arctic water-beetles, and very large newts and entomostraca—fish of all kinds being completely absent.

VIII. ON FOUR NEW SPECIES OF *BELYTA.*

The species of *Belyta* are very little understood, and stand much in need of revision. The following species (all from Scotland) are, so far as I can make out, undescribed:

Belyta lativentris, *sp. nov.*

Black; covered with longish pale hair; the base and apex of scape and joints 2-6, red; legs piceous-red, the femora more or less infuscated; the coxæ black, except at apex.

Antennæ covered with microscopic pile; the second joint is a little more than half the third,

which is more than double the length of fourth; the remaining joints to the last much broader than long; the last joint is conical at apex, and double the length of penultimate. Head densely pilose; front largely projecting. Pronotum aciculated. Mesonotum smooth and shining, flat; the sutures broad, moderately deep; the fovea at base of scutellum large, deep, much wider than long. Metanotum aciculated; the sides finely rugose; at the sides the apex projects into two prominent teeth, cleft in the middle. Petiole as long as posterior coxæ, rugosely reticulated, and with one or two indistinct carinæ above. The second abdominal segment is striolated, the striations deep, widely separated; in the centre is a long deep depression extending to near the middle; segments 3-5 equal, the sixth longer, seventh if anything longer than sixth. The abdomen is broad and flat, and is somewhat longer than the thorax. Wings flavo-hyaline, nearly as long as the abdomen and thorax united; the nervures are testaceous.

Allied to *B. sanguiolenta.*

Length, $5\frac{1}{2}$ mm.

Belyta forticornis, *sp. nov.*

Black, pilose, antennæ (except the apical 7 joints, which are fuscous) and legs ferruginous; the base of abdomen and petiole piceous.

The second and third joints of the antennæ are narrow at the base, broad and truncated at the apex; joints 4-10 moniliform, 11-14 wider, much broader than long; the third is double the length of the fourth; the last is conical, double the length of fourteenth. Prothorax largely produced; finely rugose; a large oblong fovea in the centre. The sides of mesonotum are depressed; scutellar fovea oval, large, deep; scutellum separated from the rest of the notum by the sides becoming depressed, the raised hinder portion narrowing towards the apex.

Metanotum finely aciculated, the carina bifurcating a little past the middle; the area formed by the bifurcation is narrow. Petiole stout, broad, as long as the hind coxæ; obscurely rugose; an indistinct keel in the centre. The base of the second abdominal segment is striolated; a suture in the centre; third and fourth segments equal; fifth shorter; sixth nearly as long as the preceding two together; the seventh is nearly as long as the preceding three; eighth small. The abdomen is longer than the thorax, and is wider in the centre than it. Wings double the length of petiole, abbreviated.—Female.

Length, 4 mm.

Differs from *B. depressa* in being longer, in having longer antennæ, with more moniliform joints; the petiole thicker; the metathoracic area much narrower, the femora more slender, and the scutellum more distinctly separated from the sides.

Cadder Wilderness.

BELYTA MONILIATA, *sp. nov.*

Black, pilose; antennæ and legs ferruginous; base of posterior coxæ and apex of antennæ blackish.

Antennæ covered with a close pubescence; as long as the abdomen and half of the thorax together; the second joint is a little longer than the fourth; the third longer than the following three united; the fourth to penultimate subequal, moniliform; the last one-half longer than the preceding, bluntly conical at apex. Front considerably projecting. Pronotum above finely rugose, well developed. Sutures of mesonotum and scutellar fovea large, deep. Metanotum smooth, shining, the sides aciculated, narrowed towards the apex, which is produced into a short blunt tooth. Petiole the length of hinder coxæ, with four keels, two above and one at each side; the space between them obscurely crenulated. Base of second segment striolated, a short suture in the middle; segments

3-6 subequal; the seventh larger. Abdomen narrower than the thorax, bulging out considerably in the middle. The keel in the metanotum is cleft before the middle. In the wings the radial cellule is closed.

Length, $4\frac{1}{2}$ mm.

The long third joint of the antennæ is very characteristic.

Mugdock Wood.

Belyta mullensis, *sp. nov.*

Black; legs blackish, fuscous; apex of coxæ, trochanters, base and apex of femora largely, base of tibiæ and tarsi, piceous-red; wings fuscous; radial cellule closed.

Antennæ as long as the body; the basal joint longer than the second and third together; the third a very little longer than fourth; last more than one-half longer than the thirteenth. Pronotum well developed, finely punctured, depressed in the centre. Scutellar fovea large, shallow, wider than long. Scutellum raised. Metanotum finely aciculated, the keel cleft a little past the middle; at the apex is a well-marked transverse bordering carina; the apex at the side is produced into a short single blunt tooth. Petiole longer than the hinder coxæ, with four not very clearly defined keels; the rest finely punctured. The base of second segment is slightly striolated; a long suture is in the centre. Segments 3-5 subequal, shorter than the sixth and seventh; the eighth longer than the seventh. The abdomen is rather longer than the thorax; the petiole on the under side is covered with long sparse white hair; the apex and sides of abdomen covered more closely with a shorter hair; the thorax with fuscous hair.

Length, 5 mm.

Mull.

XXXII.

METEOROLOGICAL NOTES FOR 1885, *AND REMARKS ON THE STATE OF VEGETATION IN THE PUBLIC PARKS OF GLASGOW.*

By D. M'LELLAN, Superintendent of Parks.

[Read 30th March, 1886.]

In marked contrast to the year 1884, the season of 1885 was very variable, extremes of heat and cold often occurring during 24 hours. Rain fell copiously when it was not required for the crops, and when it would have been of advantage to them it was wanting. It is therefore to be regretted that 1885 cannot be classed with its predecessor as a prosperous year for the farmer and the gardener.

January was rather an open month for the season, with cold cutting east winds, and little or no sunshine. 65 degrees of frost were registered on 15 mornings, as compared with 12 degrees of frost on 7 mornings in January of the previous year. The rainfall was 2·45 inches, and there were 19 dry days during the month. The average temperature was 36°, the prevailing winds being from the east by north. The Christmas Rose was in flower on the 8th of the month.

February was also extremely mild, but with more sunshine, and with frequent short snaps of frost on 9 mornings, registering in all 45°. 3·60 inches of rain fell on 16 days, and the average temperature was 38°. The prevailing winds were from the south by west. At the Queen's Park the Snowdrop was in flower on the 6th, the Winter Aconite on the 8th, the *Garrya elliptica* and Primrose on the 12th, the Crocus, *Daphne Mezereum*, and *Hepatica* on the 25th, and Common Daisies were plentiful throughout the month.

March was a cold month for the season of the year, and we do not find much improvement on the temperature from the preceding month. The rainfall was considerably below the average, the total being only 1·14 inches on 10 days. The thermometer was at or below the freezing point on 15 mornings, registering 41° of frost. The prevailing winds were west by south, and the average temperature was 39·1° The *Erica herbacea* flowered on the 8th, *Rhododendron præcox* and *R. nobilianum* on the 24th, and the Daffodil, Crocus, and Hyacinth on the 31st.

During the first half of April there was a continuation of the cold dry weather experienced during February; but after the 16th the day temperature rose considerably, and, with more sunshine, the weather was favourable for the sowing of seeds, and for vegetation generally. The rainfall was only 1·40 inches, and there were 20 days on which no rain fell. The temperature averaged 45°; and during the month there were 9 degrees of frost registered on 4 mornings during the first week. For the first half of the month the prevailing winds were from the east by north, and for the second half south by west. The Hyacinth was in flower at the Kelvingrove Park on the 2nd, and the *Pulmonaria officinalis* on the 10th, the Balsam Poplar coming into leaf on the 11th, and the *Berberis Darwinii* on the 31st.

May proved to be a most ungenial month, and was remarkable for the severe frost which prevailed from the 7th to the 10th, accompanied with showers of sleet and hail. The last two weeks of the month were fairly good; and vegetation made rapid progress, though much behind previous years. There were 12° of frost registered on 5 mornings; and the total rainfall was 2·84 inches, with 10 dry days. The average temperature was 46·1°, the prevailing winds being from the west by south. The Double-cherry was in flower on the 9th, and the

Bird-cherry on the 19th; the Oak came in leaf on the 20th, and the Ash on the 28th; and the Lilacs and Laburnums were fast bursting into bloom towards the end of the month.

June was the dryest month of the year, as the total rainfall was only ·80 of an inch; and there were 21 dry days during the month. The temperature was exceptionally variable, as on several days the thermometer stood at and above 78° in the shade, and on several evenings it fell to within a few degrees of the freezing point. Towards the end of the month trees, shrubs, and all kinds of crops suffered very severely for want of rain, as there is no season of the year in which vegetation suffers more from drought than in early summer. The average temperature was 56·1°, the same as in 1884. The prevailing winds were from the south by west. Flowering trees and shrubs bloomed very profusely during the month, the most noticeable being Hawthorns, Laburnums, and Services.

July was the only truly summer month of 1885, with an average temperature of 60° and brilliant sunshine. There were occasional slight showers on 13 days, giving a total of 1·47 inches—a rainfall not nearly sufficient for the crops owing to the continuous drought of June and the great heat of the sunshine. The prevailing winds were from the south by west.

The weather during August was cold for the season of the year, with a low temperature, averaging 55·1, being 5° lower than in 1884. On the 28th and following evenings the thermometer stood at 35°, or within 3° of the freezing point. Rain fell more or less on 8 days, registering 2·52 inches. The prevailing winds up to the 15th were from the south-west, and thereafter east by north. Owing to the absence of sunshine and heat during the month, vegetation remained nearly at a standstill, and consequently the harvest was a late one.

September, which is always looked forward to by

the gardener and husbandman with anxious hopes, turned out to be one of the worst harvest months on record. The thermometer fell to the freezing point on the 1st of the month, and 9° of frost were registered on 3 mornings towards the end of the month. The average temperature was also low—52·1. Rain fell on 20 days, giving a total rainfall of 5·01 inches—the highest rainfall of the year, and considerably more than double the total in September, 1884. The prevailing winds were from the west by south.

October was a fairly good month. The rainfall was only 2·79; and the last 15 days of the month were dry, with the prevailing winds from the east by north, which enabled the farmers to harvest the remainder of their crops—unfortunately, however, in many cases worthless. The thermometer was at or below the freezing point on 5 mornings, registering 23° of frost, and the temperature averaged 43·1.

November proved to be a good dry month for the time of year, with a comparatively low average temperature of 40°. The total rainfall was 2·49 inches, and the dry days 14. The thermometer was at or below the freezing point on 6 mornings, registering 58° of frost. The Christmas Rose was in flower at the Kelvingrove and the Alexandra Parks during the first week of the month.

December was the most variable month of the year, extremes of heat and cold succeeding one another at very short intervals. 100° of frost were registered on 10 mornings, the average temperature being 37·1. The dry days were 17, the total rainfall being 2·19 inches. There was a slight fall of snow on the 9th, and about 4 inches fell on the 28th and 29th, but as it was accompanied with high winds it did not lie long on the ground.

The following summary and comparison with the previous year may be of interest:—

The highest day temperature in the shade during 1885 was upon the 24th and 30th July, when the

thermometer registered 83°. During 1884 the highest temperature was upon the 8th of August, when the thermometer stood at 87°.

The lowest night temperature in 1885 was upon the 16th November and 7th December, when the thermometer was at 15°, registering 17° of frost; while in 1884 the lowest reading was upon the 23rd December, when the thermometer fell to 19°, or 13° of frost.

On 62 mornings during 1885 the thermometer was at or below the freezing point, registering a total of 361° of frost, as compared with 195° of frost on 58 mornings during 1884. The average temperature for 1885 was 46°, as compared with 47° in 1884.

Rain fell more or less on 165 days in 1885, giving a total of 28·70 inches, as compared with 173 days during 1884, and a total rainfall of 40·54 inches, thus showing in favour of 1885 by 8 dry days, and 11·84 inches less of rain.

It will be observed from the foregoing notes and comparison that the year 1885 has been rather a remarkable one. The rainfall has been the lowest for the last 10 years, with the exception of 1878, which registered 26·18 inches, or 2·52 inches less. A peculiar feature of the rainfall in 1885 is, that although it was 11·84 inches less than its predecessor, rain fell on nearly the same number of days. Unfortunately it was sent very sparingly during the summer months, and crops of all kinds suffered more or less in the months of June and July. In the public Parks it was only by copious and frequent watering that many trees, shrubs, and flowers survived; and in most cases the horse-chesnuts dropped their leaves. The weather, however, during August was more genial; and towards the end of the month the show of flowers in the Parks and Squares was fairly good. The two following months, September and October, were wet, cold, and variable. This is much to be regretted, as it is chiefly to this season that gardeners and farmers

look for the result of their labours, and for the preparation of trees and shrubs for another year's crop of flowers and fruit. Chrysanthemums and Rhododendrons did not set their flower buds at all well, and the bloom of the former all over the West of Scotland has been very poor. Altogether, the outlook for fruit and flowers during 1886 is not very bright.

It is worthy of remark, however, that two consecutive bad seasons rarely succeed each other, and that although 1885 proved to be such a disastrous year for gardeners and agriculturalists, the two previous seasons were above the average. We may therefore hope that 1886, upon which we have now entered, will be a more prosperous year for all concerned than its predecessor has been. It is, however, rather interesting to note that the year 1878—already quoted as a remarkably dry season—was succeeded by extremely severe weather in the early months of 1879, when frost and snow prevailed, 249° of frost being registered in January, and a total of 684° during the year. We are experiencing, during the first month of 1886, very similar weather; and it is sincerely to be hoped that we are not to have during the coming year a recurrence of the weather of 1879, which, from first to last, proved to be most disastrous to vegetation all over Scotland.

Subjoined is the Meteorological Record for the last three years, as kept at the Queen's Park, and the averages for the last 10 years.

COPY OF METEOROLOGICAL RECORD KEPT AT QUEEN'S PARK, GLASGOW.

RAIN-GAUGE ABOVE SEA LEVEL, 143·95.

MONTH.	1883.				1884.				1885.				AVERAGES FOR THE LAST 10 YEARS.			
	Rainfall.	THERMOMETER. Average. Max.	Min.	Dry Days.	Rainfall.	THERMOMETER. Average. Max.	Min.	Dry Days.	Rainfall.	THERMOMETER. Average. Max.	Min.	Dry Days.	Years.	Rainfall.	Average Temperature.	Dry Days.
January, ...	6·18	43	34	14	5·55	44	37	12	2·45	40	32	19	1876	37·31	45	195
February, ...	2·29	46	35	10	5·04	44	35	15	3·60	42	34	12	1877	48·03	46	131
March, ...	1·25	44	31	23	2·29	47	36	16	1·14	47	32	21	1878	26·18	46	225
April, ...	2·02	53	37	18	·72	53	37	20	1·40	53	37	20	1879	30·93	43	215
May, ...	2·03	58	40	24	2·92	59	41	14	2·84	55	38	10	1880	32·09	46	224
June, ...	2·54	64	46	18	·77	67	46	18	0·80	67	46	21	1881	33·30	45	205
July, ...	3·48	68	49	15	5·38	68	51	10	1·47	70	50	18	1882	41·35	46	173
August, ...	4·21	67	49	18	2·71	70	51	20	2·52	65	46	23	1883	40 87	47	200
September, ..	3·47	63	46	19	2·29	64	47	15	5·01	61	44	10	1884	40·54	47	192
October, ...	3·28	55	40	18	2·95	54	41	19	2·79	50	37	15	1885	28·70	46	200
November, ...	5·82	45	36	10	3·80	45	34	19	2·49	44	36	14				
December, ...	4·30	44	36	13	6·12	40	31	14	2·19	42	33	17				
	40·87	54	39	200	40·54	54	40	192	28·70	53	39	200		35·93	45·7	196

D. M'LELLAN.

XXXIII.

GONOMETA POSTICA (Walker).

BY J. E. SOMERVILLE, B.D.

[Read 30th March, 1886.]

In the spring of 1884 I paid a short visit to South Africa. About the middle of February I was in the Eastern province of Cape Colony, in the neighbourhood of Kingwilliamstown, the chief town of what used to be called British Caffraria. Over a very large part of South Africa one of the most common trees is the Doornboom of the Dutch, the Mokohala of the Kaffirs, the *Acacia horrida* of the botanist. The tree, which occasionally attains a height of 25 or 30 feet, but is generally much less, covers extensive tracts of barren and unoccupied land. Its small pinnate leaves and scanty foliage do little to protect the soil from the strong sunbeams. The tree, as its name indicates, is very thorny; but the size and number of the thorns vary much. In some places the trees are comparatively free, in others they are covered with enormous spikes four inches or more in length. Previous to my visit there had been months of drought, and things had a parched look. To add to the forlorn appearance of the country, the Acacia trees had suffered from the ravages of an insect, whole branches being stripped and bare. On examining the trees they were found to be attacked by a hairy caterpillar of gigantic dimensions. The specimens, which at the time were mostly full-grown, were above four and a half inches long, of a rich deep black colour, with a few scattered white hairs, the head and feet being reddish brown. I found them extending over a considerable area from the Kei river on the east to

the western end of the Amatola hills at Pirie. On many of the branches the large cocoons were to be seen either in a fork or attached to the stem. I collected a number of the larvæ, which in a few days span up. In spite of their thick woolly coat, many of them had evidently been attacked by some ichneumon parasite, and were sickly, and so unable to get to work fast. In the hotel, I kept them in chip boxes which had only the smallest apertures between the lid and the box; yet this sufficed for the admission of innumerable swarms of exceedingly small black ants. They scrambled in in thousands, till the boxes were perfectly filled with the moving black mass, and they gave the expiring caterpillars no peace till the death-struggle was over. I feel persuaded, in spite of Sir John Lubbock's experiments, that the African ant, whatever may be said of his British brother, is possessed of the sense of smell, and has a very keen nose indeed.

I brought the cocoons to this country, and in the beginning of the following July the moths emerged. Through the kindness of Mr. A. G. Butler of the British Museum they have been named for me. The species is *Gonometa postica*, Walker. The males, as in some of our British *Bombyces*, are only half the size of the females, and, considering the dimensions of the larvæ, somewhat small. They are of a chocolate brown, with a paler band across the middle of the fore-wing. The fore-wings are pointed, while the hind ones are cut square, and are remarkable as having their hind margin transparent and destitute of plumes. The body has a yellow ring near the tip. The females, two of which emerged but unfortunately did not expand properly, are clumsy things; they are paler in colour, with bands of grey, the wings being rounder, and the body clothed with thick woolly yellow plumes. The antennæ are pectinated, like those of *Zeuzera æsculi*, being narrow at the tip but very broad at the base.

The cocoons, some of which are two inches in length, are attached to the branches like those of the "drinker moth," and are very hard and woody like those of the "puss moth." As is usual with hairy caterpillars, the creatures, as they spin, work in their own hair into the silk. This makes the cocoon a most unpleasant object to handle, since the hairs are apt to come out and irritate the skin, as is the case with the cocoons of many of our home species. The eggs are large and of an olive brown, but present no peculiarity. I was unable to obtain any fertile eggs, otherwise I might have been able to keep down the excessive growth of Acacias in the Botanic Garden!

XXXIV.

THE DECAPOD AND SCHIZOPOD CRUSTACEA OF THE FIRTH OF CLYDE.

BY J. R. HENDERSON, M.B., F.L.S.

[Read 24th November, 1885.]

THE Crustacea of the Firth of Clyde have hitherto received but scant attention, no list having as yet appeared which treats of the higher forms found in this important estuary. A list of the Ostracoda is given in the *Fauna and Flora of the West of Scotland*, published during the meeting of the British Association at Glasgow in 1876; and the author, Mr. David Robertson, has since made considerable additions to this*; indeed, from the careful manner in which this indefatigable naturalist has explored the district in search of these minute organisms, there is perhaps no similar area in Britain which can show a larger number of recorded species. Mr. Robertson has also for many years paid special attention to the Amphipoda, and is engaged at present in preparing a list, which, along with many interesting observations on the habits of the members of this group, cannot fail to be of value to subsequent workers. Dr. G. S. Brady records several Clyde species in his *Monograph of the Free and Semi-Parasitic Copepoda of the British Islands*, one of the more recent publications which we owe to the Ray Society.

As regards higher Crustacea, the work previously done in the district may be briefly alluded to. In

* See his later work on the West of Scotland Ostracoda, forming one of a series of papers on the Fauna of Scotland published by the Glasgow Natural History Society.

1845, Mr. R. M'Andrew, the well-known conchologist, dredged in Loch Fyne, and subsequently, along with Prof. Edward Forbes, obtained a number of interesting species, several of which are described by Prof. Bell in his *History of the British Stalk-eyed Crustacea.* The Rev. Dr. Landsborough, author of *Excursions to Arran,* and other popular scientific works, was among the foremost of earlier workers in the Firth of Clyde; along with Major Martin of Ardrossan, and other naturalists, he carried on dredgings, chiefly in Lamlash Bay and off the Cumbraes. During the year 1856 the Rev. Dr. Miles, of Glasgow, and Dr. Greville—better known for his researches in cryptogamic botany—aided by a grant of money from the British Association, carried on a series of dredgings, principally in Lamlash Bay. The Crustacea collected by them, amounting only to sixteen species, are recorded in the *British Association Report* for that year; and this list was afterwards reprinted, along with a few of Landsborough's and Martin's finds, in the Appendix to Dr. Bryce's *Geology of Arran and the other Clyde Islands.* The Rev. A. M. Norman, during a short residence at Cumbrae in 1853, collected many interesting invertebrates; and a few of the rarer crustaceans are recorded in some of his own papers, and in Adam White's *Popular History of the British Crustacea,* published in 1857. More recently, in the first of two papers on the invertebrate fauna of Lamlash Bay, in the *Proceedings of the Royal Physical Society of Edinburgh,* 1879-80, Prof. Herdman of Liverpool enumerates twenty-four species of Decapoda taken by himself in that rich dredging locality. To Mr. Robertson, however, is due the credit of having investigated the Clyde fauna more thoroughly than any other naturalist; and his long-continued dredgings, extending over the last thirty years, have added not a few species, some of which are still recorded solely on his authority.

With the exception of a small amount of shore collecting and dredging done previously, our work

has been confined to the past year. In March we carried on a series of dredgings throughout the Firth; and these were repeated, though on a much more extended scale, in the months of July and August. During both these periods, however, there were great facilities in the way of collecting, our investigations being carried on continuously from the steam-yacht "Medusa," of the Scottish Marine Station, Granton, which is fitted up with all modern appliances for the work. We were enabled to form extensive collections in most of the invertebrate groups; and not a little of the success was due to the fact that the operations were under the direct superintendence of Mr. John Murray, of the "Challenger" expedition.

The naturalists who have made this district the scene of their investigations, appear all without exception to have confined their labours to some special part of the Firth, and little or no work has apparently been done in the deep water beyond the fifty-fathom line. In the present list we have arranged together all the previously-known species, and added to these a number which now appear for the first time from the Firth of Clyde, including five not previously recorded from the British coasts. The distribution of the more common forms has also been worked up, and many new localities are added. It can hardly be expected that operations carried on for so short a period can have exhausted even the higher Crustacea of so rich a district, and doubtless novelties yet remain to reward the efforts of future investigators.

Some of the more important features in the distribution of the higher Crustacea in the Firth are worthy of short notice here. Between tide-marks we meet with the ubiquitous *Carcinus maenas*, and this species occurs far up the estuary, even where the water is brackish. It is also found throughout the lochs, where, owing to the sudden

deepening of the water, the tidal belt is considerably curtailed, and the shore fauna necessarily scanty. Towards the mouth of the Firth the following species are commonly met with, under stones at low-water: *Galathea squamifera*, *Porcellana platycheles*, *Portunus puber*, *Cancer pagurus*, and *Eupagurus Bernhardus*. In the rock pools we find *Palaemon squilla*, *Mysis flexuosus*, and *Hippolyte varians*, and on the sandy shores *Crangon vulgaris*. As compared with the Crustacean fauna of other parts of Britain, we miss in the tidal zone the species of *Xantho**, *Gebia*, *Alpheus*, and *Callianassa*, so characteristic of the Southern shores; while *Arctopsis tetraodon*, *Athanas nitescens*, and *Palaemon serratus*, also appear to be absent. In the laminarian zone occur *Hyas araneus*, *Homarus gammarus*, species of *Hippolyte*, *Palaemon*, and various *Mysidae*. Passing next to the coralline zone, which, in the Firth of Clyde, includes the greater part of the hard or stony ground, we find Crustacea to be much more numerous both in number of species and individuals. The extensive nullipore banks at Skelmorlie, the Tan (Cumbrae), and Lamlash Bay, afford shelter to many interesting forms. There, especially, we meet with the various species of *Portunus*, *Inachus*, and *Stenorhynchus;* also *Galathea dispersa*, *G. intermedia*, *Porcellana longicornis*, *Pandalus brevirostris*, *Eupagurus Prideauxii*, *Ebalia tuberosa*, *Eurynome aspera*, and *Hyas coarctatus*. The natives of Southern waters apparently conspicuous by their absence, are, *Crangon fasciatus*, *C. trispinosus*,† *Polybius Henslowii*, *Portunus longipes*, *Dromia vulgaris*, *Diogenes varians*, *Scyllarus arctus*, and several species of *Hippolyte*, *Palaemon*, and *Mysidae*. We also look in vain for the northern

* *Xantho rivulosa* is not uncommon in some parts of the West of Scotland, and will yet, in all probability, be found on the Arran shores. *X. florida* also occurs, though more rarely.

† *Crangon trispinosus* occurs along the East coast of Scotland as far as the Shetland Isles. It may yet be found in the Firth of Clyde.

Portunus tuberculatus, *Eupagurus excavatus*,* *Sabinea septemcarinata*, and *Lophogaster typicus*. The deep-water area may be said to extend from a depth of forty to that of a hundred fathoms, the bottom everywhere consisting of soft mud. Roughly speaking, these conditions are met with in Loch Long opposite the mouth of Loch Goil, and in the centre of the channel, from a point between Cumbrae and Bute down to the mouth of the Firth; also in Kilbrannan Sound and Loch Fyne. The forty-fathom limit is also just reached in several other localities as Loch Striven, between Dunoon and the Cloch Light, off Wemyss Bay, &c. It was in that which we have termed the deep-water area that our most interesting captures were made, and in which the majority of future additions to the Clyde fauna may be looked for. The deepest water occurs in a spot of limited extent off Skate Island, near the mouth of Loch Fyne. Here, after careful sounding on two occasions, the bottom was only reached with a line one hundred and five fathoms in length. In this locality occurred a number of very interesting invertebrates,† and two crustaceans are worthy of special mention, viz.: *Pasiphaea sivado* (new to Scotch waters), and *Crangon echinulatus*, a Norwegian species only previously met with in Britain off the Shetland Islands and in the Minch. The characteristic species met with in deep water are, *Crangon Allmani*, *Hippolyte securifrons*, *Caridion Gordoni*, *Pandalus annulicornis*, and *Nyctiphanes norvegica;* while *Calocaris Macandreae*, *Nika edulis*, &c., though confined to this area, occur less frequently.

* This species is the *Pagurus tricarinatus* of Norman. It is well figured and described by Prof. G. O. Sars, in his recently-published report on the Crustacea of the Norwegian Arctic Expedition.

† The molluscan fauna of this locality is especially rich, the following species occurring among others: *Lima elliptica*, *Nucula sulcata*, *Neaera cuspidata*, *N. costellata*, *N. abbreviata*, *Axinus ferruginosus*, *Rissoa abyssicola*, and *Idalia Leachii*. We captured upwards of two hundred living specimens of *Pecten septemradiatus* in a single haul.

When working at considerable depths and on a soft bottom, an ordinary dredge will be found of little service, owing to the fact that it sinks in the mud and fills almost immediately. This difficulty is to a great extent overcome by the use of a light trawl which can skim rapidly over the oozy surface. The one we used had a breadth of beam of seven feet, and was fitted with a net of the ordinary "shrimp mesh." By means of this, many of the quick-swimming Crustacea, which usually escape the dredge, will be taken in abundance. The method first adopted by Mr. Murray on board the "Challenger," of fixing one or more tow-nets to the beam of the trawl, is also of service, especially for capturing the smaller Schizopods and Cumacea, though of course it is impossible to determine the exact depth at which they entered the net.

The crustacean fauna of the Clyde, as compared with that of the Forth, offers some points of interest. In the first place we must note the apparent total absence of several species from the latter district, as *Portunus arcuatus*, *Eupagurus Prideauxii*, *Pilumnus hirtellus*, *Palinurus homarus*, *Crangon sculptus*, *C. echinulatus*, *Nika edulis*, and *Pasiphaea sivado*. Several species met with in shallow water in the Clyde, and at no great distance from land, as *Inachus dorsettensis*, *Lithodes maia*, *Ebalia Cranchii*, and *Eurynome aspera*, occur in the Forth at the mouth of the estuary beyond the Isle of May, and the majority of the specimens taken come from the deep-sea lines of the fishermen. It must, however, be borne in mind that with the single exception of a small spot near Queensferry, the depth in the Firth of Forth proper nowhere reaches forty fathoms, nor do we meet with this depth till we have passed a considerable distance beyond the Isle of May or seaward limit. On the so-called oyster-banks the following species are commonly met with: *Stenorhynchus rostratus*, *Porcellana longicornis*, *Galathea dispersa*, *Portunus depurator*, *P. holsatus*,

P. marmoreus, *P. pusillus*, *Hyas araneus*, *H. coarctatus*, *Pandalus annulicornis*, and *Eupagurus pubescens*. *Anapagurus laevis*, and *A. Hyndmanni*, are also not uncommon, though the specimens are much smaller than those from the Clyde. The rarer species are *Eurynome aspera*, *Hippolyte pusiola*, *H. spinus*, *Pandalus brevirostris*, *Munida rugosa*, and *Inachus dorsettensis*. *Macropsis Slabberi* (Van Bened.), taken by us last year chiefly in the higher reaches of the Forth, has apparently not yet been met with elsewhere in Britain.

Prof. Bell's *History of the British Stalk-eyed Crustacea* still remains the standard work on the subject; but it is now manifestly out of date, the descriptions are frequently inadequate, and sufficient attention is not paid to the law of priority in the naming of species. Since the appearance of that work in 1853, many additions have been made to the British list, and various papers on the subject will be found by W. Thompson, Gosse, Kinahan, Norman, Spence Bate, and others; one of the more recent contributions being a series of articles on the British Stalk-eyed Crustacea, by Messrs. Carrington and Lovett, which appeared in the *Zoologist* for 1881. Our own list affords a good example of the progress made in this department of marine zoology within the last thirty years; twenty-one species, or nearly a fourth of the total number recorded from the Firth of Clyde, have been added to the British fauna since the publication of Bell's work. A large number of these will be found among the Schizopoda, a group which has not been thoroughly worked up in Britain, and one in which we may yet reasonably expect further additions to our fauna.

In order to illustrate more fully the subject of geographical distribution, we have drawn up in tabular form a list of the species of higher Crustacea recorded from the west coast of Scotland, those not yet taken in the Clyde district being marked by an asterisk. The remainder of the

British coasts (omitting the west coast of England) are here perhaps somewhat artificially divided into three areas, which, with a few of the more important papers illustrating the local distribution of Crustacea in Britain, are briefly enumerated below. The northern and southern distribution of the species in Europe is also indicated. In the preparation of the former we have been chiefly guided by the works of Lilljeborg, Göes, M. Sars, and G. O. Sars; as regards the latter we are mainly indebted to Prof. Camil Heller's *Die Crustaceen des Südlichen Europa.* To the Schizopoda admirable guides exist in Prof. G. O. Sars' monographs of the Norwegian and Mediterranean *Mysidae.* It may be stated generally that the marine fauna of the West of Scotland presents a blending of northern and southern species, several of the former apparently not venturing as far as the English coasts.

I. North Coast, including the Shetland Islands and Moray Firth. The Rev. Dr. Norman was among the first to point out that the fauna of the latter district resembles that of the west coast and Shetland Islands.

Rev. A. M. Norman—Shetland Final Dredging Report. *Brit. Assoc. Rep.*, 1868.

Rev. G. Gordon—List of the Crustaceans of the Moray Firth. *Zoologist*, 1852.

T. Edward—List of Banff Crustacea in the appendix to Smiles' *Life of Edward.*

II. East Coast of Scotland and England, from Aberdeenshire to the Straits of Dover.

G. Sim—The Stalk-eyed Crustacea of the North East Coast of Scotland. *Scottish Naturalist*, 1871-72.

W. A. M'Intosh—The Marine Invertebrates and Fishes of St. Andrews. *Ann. Mag. Nat. Hist.* (ser. 4), vol. xiv., 1874; also published separately.

G. Leslie and W. A. Herdman—The Invertebrate Fauna of the Firth of Forth. *Proc. Roy. Phys. Soc. Edin.*, 1880-81; and separately.

A. Metzger—*Crustaceen der Nordsee Expedition*, 1872.

Rev. A. M. Norman—Report on the Crustacea dredged off the coasts of Northumberland and Durham, 1862-64. *Northumb. Nat. Hist. Trans.*, 1867.

III. South Coast, including the south coasts of England and Ireland, and the west coast of Ireland. For the Crustacea of this district see Bell's *British Stalk-eyed Crustacea*, and papers by Carrington and Lovett, Thompson, Gosse, Norman, Bate and Rowe, &c. The following are perhaps the most important:

W. Thompson—List of Crustacea taken at Weymouth from March, 1850, to March, 1851. *Zoologist*, 1851.

E. Parfitt—A Catalogue of the Crustacea Podophthalmata of Devonshire. *Devon. Assoc. Trans.*, 1871.

A. G. Melville—List of Crustacea Podophthalmia of Galway Marine Districts. *Nat. Hist. Rev.*, 1857.

West Coast of Scotland.	Scandinavia.	BRITAIN. North Coast.	BRITAIN. East Coast.	BRITAIN. South Coast.	Mediterranean.
DECAPODA.					
BRACHYURA.					
Inachus dorsettensis, - -	+	+	+	+	+
,, dorynchus, - -		+	+	+	+
,, leptochirus, - -		+	+	+	+
Maia squinado, - - -				+	+
Hyas araneus, - - -	+	+	+	+	
,, coarctatus, - -	+	+	+	+	
Achaeus Cranchii, - -				+	+
Stenorhynchus rostratus, -	+	+	+	+	+
,, longirostris,		+	+	+	+
Eurynome aspera, - -	+	+	+	+	+
Cancer pagurus, - - -	+	+	+	+	+
*Xantho florida, - - -				+	+
* ,, rivulosa, - -	+	+		+	+
Pilumnus hirtellus, - -			+	+	+
Portunus puber, - - -		+	+	+	+
,, corrugatus, -		+	+	+	+
,, arcuatus, - -	+			+	+
,, depurator, - -	+	+	+	+	+
,, marmoreus, -		+	+	+	+
* ,, holsatus, - -	+	+	+	+	+
,, pusillus, - -	+	+	+	+	+
Carcinus maenas, - -	+	+	+	+	+
Portumnus latipes, - -		+	+	+	+
Atelecyclus septemdentatus,	+	+	+	+	+
Corystes cassivelaunus, -		+	+	+	+
Gonoplax angulata, - -				+	+
Pinnotheres pisum, - -	+	+	+	+	+
Ebalia tuberosa, - - -	+	+	+	+	+
,, tumefacta, - -	+	+	+	+	+
,, Cranchii, - - -	+	Moray F.	+	+	+
ANOMURA.					
Porcellana platycheles, -		+	+	+	+
,, longicornis, -	+	+	+	+	+
Lithodes maia, - - -	+	+	+		
Eupagurus Bernhardus, -	+	+	+	+	
,, Prideauxii, -	+	+		+	+
,, pubescens, -	+	+	+	+	
,, cuanensis, -	+	+	+	+	
Anapagurus Hyndmanni,		+	+	+	
,, laevis, - -	+	+	+	+	+
,, ferrugineus, -		+	+	+	
Munida rugosa, - - - -	+	+	+	+	+
Galathea squamifera, -	+	+	+	+	+
,, strigosa, - -	+	+	+	+	+
,, nexa, - - -	+	+	+	+	+
,, dispersa, - -		+	+	+	
,, intermedia, - -	+	+	+	+	

West Coast of Scotland.	Scandinavia.	BRITAIN. North Coast.	BRITAIN. East Coast.	BRITAIN. South Coast.	Mediterranean.
MACRURA.					
Calocaris Macandreae,	+	Moray F.	+		+
Palinurus homarus,				+	+
Homarus gammarus,	+	+	+	+	+
Nephrops norvegicus,	+	+	+	+	+
Crangon vulgaris,	+	+	+	+	+
,, spinosus,	+	+	+	+	+
,, sculptus,		Moray F.		+	+
,, Allmani,	+	+	+	+	
,, nanus,	+	+	+	+	
,, echinulatus,	+	+			
Nika edulis,		+		+	+
*Hippolyte spinus,	+	+	+		
,, securifrons,	+	+	+		
,, Cranchii,	+	+	+	+	+
,, pandaliformis,	+	+		+	
,, pusiola,	+	+	+	+	
* ,, cultellata,	?				
(?=H. polaris, Sabine),					
Virbius varians,	+	+	+	+	+
,, productus,					
Caridion Gordoni,	+	+	+		
Pandalus annulicornis,	+	+	+	+	
,, brevirostris,	+	+	+	+	+
Palaemon squilla,	+	+	+	+	+
Palaemonetes varians,	+		+	+	+
Pasiphaea sivado,				+	+
SCHIZOPODA.					
Nyctiphanes norvegica,	+	+	+		
Boreophausia Raschii,	+		+		
Mysidopsis didelphys,	+	+	+		
,, gibbosa,	+			+	+
Leptomysis linguara,	+		+	+	
Mysis flexuosa,	+	+	+	+	
,, Lamornae,	+	+		+	
,, vulgaris,	+	+	+	+	
,, neglecta,	+			+	
,, Griffithsiae,			+	+	
,, productus,				+	
,, inermis,	+	+	+		
,, arenosa,				+	+
Gastrosaccus spinifer,	+	+	+	+	

For the few species in the above list which are not yet recorded from the Clyde district, see the report on the Crustacea, &c., of the Hebrides, by the Rev. A. M. Norman, in the *British Association Report* for 1866.

Finally the writer must return thanks to the friends who have kindly assisted in the drawing up of this list. Mr. David Robertson supplied the localities for many of the known species, including a number discovered by himself in the Clyde, in addition to other valuable information; his assistance is here gratefully acknowledged. The Rev. Canon Norman also very kindly examined some of the doubtful species, and identified all the rarer Schizopods; we are also indebted to him for his opinion on several of the more obscure species. Mr. George Brook furnished the names of those species taken by himself in Loch Fyne, and lent a collection of *Mysidae* from Tarbert which included at least three rare forms.

DECAPODA.

BRACHYURA.

Subtribe MAIOIDEA.

Family INACHIDAE.

Genus INACHUS, Fabr.

INACHUS DORSETTENSIS.

Cancer dorsettensis, Pennant, Brit. Zool. vol. iv., p. 12, pl. x. fig. 1.

Cancer scorpio, Fabricius, Ent. Syst. t. ii., p. 462.

Inachus scorpio, Fabricius, Suppl. Ent. Syst. p. 358.—M. Edw., Hist. Nat. des Crust. t. i., p. 288.

Inachus dorsettensis, Leach, Malac. Brit. pl. xxii., figs. 1-6.—Bell. Brit. Crust. p. 13.

Abundant in all parts of the Clyde as far up as the Gareloch, in 5-40 fathoms, usually on hard ground. Females with ova in March.

INACHUS DORYNCHUS.

Inachus dorynchus, Leach, Edin. Ency. art. Crust. p. 431; Malac. Brit. pl. xxii., figs. 7-8.—Bell, Brit. Crust. p. 16.

Off Cumbrae, rare (Robertson).

INACHUS LEPTOCHIRUS.

Inachus leptochirus, Leach, Malac. Brit. pl. xxii., B.—Bell, Brit. Crust. p. 18.

Inachus leptorhynchus, M. Edw., Hist. Nat. des Crust. t. i., p. 289.

Firth of Clyde (Norman). Between Cumbrae and Bute, 20 fathoms, rare (Robertson).

Family MAIIDAE.

Genus Maia, Lamarck.

MAIA SQUINADO.

Cancer squinado, Rondeletius, liv. xviii., p. 401.—Herbst, Krabben und Krebse. tab. lvi.

Maia squinado, Latreille, Hist. Nat. des Crust. t. vi., p. 93.—Bell, Brit. Crust. p. 39.

A specimen said to have been taken off Dunoon was exhibited before the Natural History Society, Glasgow, by Dr. Fleming, in January, 1878. It is also stated to have been dredged by Major Martin off Ardrossan, and by Dr. Grieve on the west side of Bute. From the fact that this crab is in Britain almost confined to the south coast, it seems probable that some other species may have been mistaken—possibly *Lithodes maia.*

Genus Hyas, Leach.

HYAS ARANEUS.

Cancer araneus, Linn., Syst. Nat. i. p. 1044.
Maia ,, Leach, Edin. Ency. vol. vii., p. 394.
Hyas ,, Leach, l.c. p. 431.—Bell, Brit. Crust. p. 31.

Common between tidemarks and in shallow water. Our finest specimens were taken in the Gareloch and in Loch Goil.

HYAS COARCTATUS.

Hyas coarctatus, Leach, Trans. Linn. Soc. xi., p. 329.—Bell, Brit. Crust. p. 35.

As widely distributed and as common as the last, though usually occurring in deeper water (10-40 fathoms).

Family LEPTOPODIDAE.

Genus ACHAEUS, Leach.

ACHAEUS CRANCHII.

Achaeus Cranchii, Leach, Malac. Brit. pl. xxii. C.—Bell, Brit. Crust. p. 10.

A single specimen was taken by Mr. Hennedy off Cumbrae (Robertson).

Genus STENORHYNCHUS, Lamarck.

STENORHYNCHUS ROSTRATUS.

Cancer rostratus, Linn., Fauna Suec. No. 2027.
,, phalangium, Penn., Brit. Zool. vol. iv. pl. ix., fig. 17.
Stenorhynchus phalangium, M. Edw., Hist. Nat. des Crust. t. i., p. 279.—Bell, Brit. Crust. p. 2.

In deep water off Arran (Miles and Greville). Mr. Robertson dredged this species in former years off the Tan, Cumbrae, not uncommonly, but it has not been met with recently in this locality. Prof. Herdman states that it is common in Lamlash Bay, but we have never taken it, and on almost every occasion on which we dredged there, specimens of the next species were obtained.

STENORHYNCHUS LONGIROSTRIS.

Inachus longirostris, Fabr., Suppl. Ent. Syst. p. 358.
Macropodia tenuirostris, Leach, Trans. Linn. Soc. xi., p. 331.
Stenorhynchus longirostris, M. Edw., Hist. Nat. des Crust. i., p. 280.
Stenorhynchus tenuirostris, Bell, Brit. Crust. p. 6.

Not uncommon in 10-35 fathoms on hard ground, in several localities, as: Lamlash Bay, off Cumbrae, off Callum's Point (Bute), off Inverkip, &c. Females with ova in March and August.

Family PARTHENOPIDAE.

Genus EURYNOME, Leach.

EURYNOME ASPERA.

Cancer asper, Penn., Brit. Zool. vol. iv., p. 13, pl. x. fig. 3.
Eurynome aspera, Leach, Malac. Brit. pl. xvii.—Bell, Brit. Crust. p. 46.

Not uncommon in 10-60 fathoms, usually on hard

ground. A female was taken by Herdman in Lamlash Bay with ova in August.

Subtribe CANCROIDEA.

Family CANCRIDAE.

Genus CANCER, Linn.

CANCER PAGURUS.

Cancer pagurus, Linn., Syst. Nat. xii., i., p. 1044.—Bell, Trans. Zool. Soc. i., p. 341; Brit. Crust. p. 59.

Platycarcinus pagurus, M. Edw., Hist. Nat. des Crust. i., p. 413.

Common at low water on rocky shores. A very large specimen is preserved in the Greenock Museum, taken in the Clyde opposite that town.

Family ERIPHIDAE.

Genus PILUMNUS, Leach.

PILUMNUS HIRTELLUS.

Cancer hirtellus, Linn., Syst. Nat. i., p. 1045.

Pilumnus ,, Leach, Trans. Linn. Soc. xi., p. 321.—Bell, Brit. Crust. p. 68.

Portloy, Cumbrae, under stones at low water; only two specimens taken (Robertson).

Family PORTUNIDAE.

Genus PORTUNUS, Fabr.

PORTUNUS PUBER.

Cancer puber, Linn., Syst. Nat. xii., p. 1046.

,, velutinus, Penn., Brit. Zool. iv., p. 5, pl. iv., fig. 8.

Portunus puber, Latr., Hist. Nat. des Crust. vi., p. 10.—Bell, Brit. Crust. p. 90.

Under stones at extreme low water, Cumbrae (Norman, Robertson, *et nobis*). In shallow water off the north end of Cumbrae (*nobis*). Upper laminarian zone, Lamlash, and dredged in the bay (Herdman). Frequent in Loch Fyne, 10-12 fathoms (Brook). Several of our specimens taken in August were females with ova.

PORTUNUS CORRUGATUS.

Cancer corrugatus, Penn., Brit. Zool. iv., p. 5, pl. v., fig. 9.

Portunus ,, Leach, Edin. Ency. vii., p. 390.—Bell, Brit. Crust. p. 94.

A single specimen off the Tan Buoy, Cumbrae, 8 fathoms Melobesia ground; August, 1885.

PORTUNUS ARCUATUS.

Portunus arcuatus, Leach, Malac. Brit. pl. vii., figs. 5, 6.—Bell, Brit. Crust. p. 97.

Portunus emarginatus, Leach, *l.c.* pl. vii., figs. 3, 4 *(Var.)*

Portunus Rondeletii, Risso, Crust. de Nice t. i., fig. 3.—M. Edw., Hist. Nat. des Crust. i., p. 444.

Firth of Clyde, in the coralline zone (Norman). Off Cumbrae, not rare (Robertson). Lamlash Bay (Herdman). We obtained a young specimen of the var. *emarginatus* off Farland Point, Cumbrae, 12 fathoms.

PORTUNUS DEPURATOR.

Cancer depurator, Linn., Syst. Nat. xii., p. 1043, 23.

,, ,, var., Penn., Brit. Zool. iv., pl. iv., fig. 6A.

Portunus ,, Leach, Edin. Ency. vii. 390.—Bell, Brit. Crust. p. 101.

Portunus plicatus, Risso, Crust. de Nice p. 29.—M. Edw., Hist. Nat. des Crust. i., p. 442.—White, Pop. Hist. Brit. Crust. p. 50.

Abundant on hard ground, in 5-30 fathoms. This is certainly the commonest species of swimming-crab in the Firth of Clyde. We took females with ova in July.

PORTUNUS MARMOREUS.

Cancer depurator? Penn., Brit. Zool. iv., pl. ii., fig. 6.

Portunus marmoreus, Leach, Malac. Brit. pl. viii.—Bell, Brit. Crust. p. 105.

Taken in several localities, usually along with the last species, but much less common.

PORTUNUS PUSILLUS.

Portunus pusillus, Leach, Malac. Brit. pl. ix., figs. 5-8.—Bell, Brit. Crust. p. 112.

Portunus maculatus, Risso, Hist. Nat. de l'Eur. Mér. t. v., p. 5.

Abundant everywhere on hard ground, as far up as the Gareloch, in 5-40 fathoms.

Family PLATYONYCHIDAE.

Genus CARCINUS, Leach.

CARCINUS MAENAS.

Cancer maenas, Linn., Syst. Nat. 1043.—Penn., Brit. Zool. iv., p. 3., pl. iii., fig. 5.

Carcinus maenas, Leach, Edin. Ency. vii., p. 429.—Bell, Brit. Crust. p. 76.

Abundant everywhere between tidemarks, and occasionally dredged in shallow water. Specimens taken in the sheltered waters of the Gareloch and Loch Goil were unusually infested with *Sacculinae*.

Genus PORTUMNUS, Leach.

PORTUMNUS LATIPES.

Cancer latipes, Penn., Brit. Zool. iv., p. 5, pl. i., fig. 4.

Portumnus variegatus, Leach, Edin. Ency. vii., p. 391.—Bell, Brit. Crust. p. 85.

Platyonychus latipes, M. Edw., Hist. Nat. des Crust. i., p. 436.

Portumnus latipes, White, List Crust. Brit. Mus. p. 23; Pop. Hist. Brit. Crust. p. 43.

Washed ashore on Irvine Sands (Robertson).

Subtribe CORYSTOIDEA.

Family CORYSTIDAE.

Genus ATELECYCLUS, Leach.

ATELECYCLUS SEPTEMDENTATUS.

Cancer (Hippa) septemdentatus, Montague, Trans. Linn. Soc. xi., pl. i., fig. 1.

Atelecyclus septemdentatus, Leach, Edin. Ency. vii., p. 430; Trans. Linn. Soc. xi., p. 313.

Atelecyclus heterodon, Leach, Malac. Brit. pl. ii.—Bell, Brit. Crust. p. 153.

A single specimen from the Alland Bank, Millport Bay (Robertson).

Genus CORYSTES, Latr.

CORYSTES CASSIVELAUNUS.

Cancer cassivelaunus, Penn., Brit. Zool. iv. pl. vii., fig. 13.

Corystes dentatus, Latr., Hist. Nat. des Crust. vi., p. 122.—Couch, Cornish Fauna, p. 74.

Corystes cassivelaunus, Leach, Edin. Ency. vii., p. 395.—Bell, Brit. Crust. p. 159.

Kaimes Bay, Cumbrae, in sand below low-water mark, and washed ashore after storms. The habits of this species, especially as regards its mode of burrowing in sand, have been carefully studied by Mr. Robertson, and form the subject of a communication by him to the Natural History Society of Glasgow.

Subtribe GRAPSOIDEA.

Family GONOPLACIDAE.

Genus GONOPLAX, Leach.

GONOPLAX ANGULATA.

Cancer angulatus, Fabr., Suppl. Ent. Syst. p. 341.—Penn., Brit. Zool. iv., p. 7, pl. v., fig. 10.

Gonoplax angulata, Leach, Edin. Ency. vii., p. 430.—M. Edw., Hist. Nat. des Crust. ii., p. 61.—Bell, Brit. Crust. p. 130.

Gonoplax bispinosa, Leach, Malac. Brit. pl. xiii.

"On the Ayrshire coast, abreast of Arran" (Miles and Greville).

Family PINNOTHERIDAE.

Genus PINNOTHERES, Latr.

PINNOTHERES PISUM.

Cancer pisum, Linn., Syst. Nat. ed. x., p. 628.—Penn., Brit. Zool. iv., p. 1, pl. i., fig. 1.

Pinnotheres pisum, Latr., Hist. Nat. des Crust. vi., p. 83.—Bell, Brit. Crust. p. 121.

Pinnotheres Cranchii, Leach, Malac. Brit. pl. xiv., figs. 4, 5 (female).

Pinnotheres Latreillii, Leach, *l.c.* figs. 6-8 (immature male).

,, varians, Leach, *l.c.* figs. 9, 11 (male).

,, mytilorum, M. Edw., Ann. des Sc. Nat. sér. iii., t. xx., p. 217, pl. x., fig. 1.

Not uncommon in *Mytilus modiolus*, occasionally in *Cardium edule*.

Subtribe LEUCOSOIDEA.

Family LEUCOSIDAE.

Genus EBALIA, Leach.

EBALIA TUBEROSA.

Cancer tuberosus, Penn., Brit. Zool. iv., pl. ix. A, fig. 19.

Ebalia Pennantii, Leach, Malac. Brit. pl. xxv., fig. 1.—Bell, Brit. Crust. p. 141.

Ebalia tuberosa, White, List Crust. Brit. Mus. p. 50; Pop. Hist. Brit. Crust. p. 61, pl iv, fig. 3.

Common on hard ground, 5-30 fathoms, in various localities, as Lamlash Bay, off Cumbrae, Skelmorlie Bank, &c.

EBALIA TUMEFACTA.

Cancer tumefactus, Mont., Trans. Linn Soc. ix., p 86, pl. ii., fig. 3.

Ebalia Bryerii, Leach, Malac. Brit. pl. xxv., figs. 12, 13.—Bell, Brit. Crust. p. 145.

Ebalia tumefacta, White, List Crust. Brit. Mus. p. 49; Pop. Hist. Brit. Crust. p. 62.

Lamlash Bay (Greville *et nobis*). On the Alland Bank, Millport Bay, not rare (Robertson). Kilbrannan Sound, 15 fathoms (Brook).

EBALIA CRANCHII.

Ebalia Cranchii, Leach, Zool. Miscel. iii., p. 20; Malac. Brit. pl. xxv., figs. 7-11.—M. Edw., Hist. Nat. des Crust. ii., p. 129. —Bell, Brit. Crust. p. 148.

Lamlash Bay (Landsborough and Martin).

ANOMURA.

Subtribe PORCELLANIDEA.

Family PORCELLANIDAE.

Genus PORCELLANA, Lam.

PORCELLANA PLATYCHELES.

Cancer platycheles, Penn., Brit. Zool. iv., pl. iv., fig. 2, p. 9.
Porcellana ,, Lam., Hist. An. sans Vert. v., p. 230.—Bell, Brit. Crust. p. 190.

Cumbrae, under stones at low water (Robertson and others); specially abundant in the little creek at Portloy, Millport. Lamlash Bay, 5-15 fathoms, and between tidemarks (Herdman). With ova in July and August.

PORCELLANA LONGICORNIS.

Cancer longicornis, Penn., Brit. Zool. iv., pl. i., fig. 3.
Pisidia Linnaeana, Leach, Dict. des Sc. Nat. xviii., p. 54.
Porcellana Leachii, Gray, Zool. Miscel. p. 15.
,, longicornis, M. Edw., Hist. Nat. des Crust. ii., p. 257.—Bell, Brit. Crust. p. 193.

From low water down to 20 fathoms, common; usually on hard ground.

Subtribe LITHODEA.

Family LITHODIDAE.

Genus LITHODES, Latr.

LITHODES MAIA.

Cancer maia, Linn., Syst. Nat. i., p. 1046, 41.
,, horridus, Penn., Brit. Zool. iv., pl. vii., fig. 14, p. 7.
Lithodes arctica, Lam., Hist. An. sans Vert. v., p. 240.—M. Edw., Hist. Nat. des Crust. ii., p. 186.
Lithodes maia, Leach, Trans. Linn. Soc. xi., p. 332.—Bell, Brit. Crust. p. 165.

Loch Fyne (M'Andrew). In deep water off Arran (Miles and Greville). At Cumbrae, occasionally on the nets and fishing lines (Robertson). We trawled three specimens in shallow water off Cumbrae, two —male and female—in one haul; the latter being apparently much less frequently met with than the male. It appears to be rather common in Loch Fyne, and we met with several specimens there. Young individuals of this, as of most other Lithodids, have the spiny armature comparatively more strongly developed than adults.

This species is frequently taken by trawlers near the mouth of the Firth of Forth. We procured two females with ova in the month of January last, and from one of these succeeded in hatching the young at the Granton Marine Station; the zoea is probably the largest of any British crustacean, and it bears a remarkable similarity to that of *Eupagurus* in all its essential characters. Dr. Boas, in his able work on the classification of the higher Crustacea,* has on morphological grounds placed the *Lithodidae* along with the *Paguridae* in a distinct group of Anomura (Paguroidae). He points out that the genus *Lithodes* has in all probability been derived from *Eupagurus* or some closely-allied form.

* J. E. V. Boas, *Studier over Decapodernes Slaegtskabsforhold.* (Avec un résumé en français.) Kjöbenhavn, 1880.

Subtribe PAGURIDEA.

Family PAGURIDAE.

Genus EUPAGURUS, Brandt.

Eupagurus, Brandt, in Middendorff's Sibirische Reise; Zool. Thl. i., p. 105 (1851).

EUPAGURUS BERNHARDUS.

Cancer Bernhardus, Linn., Syst. Nat. p. 1049.
Astacus ,, Penn., Brit. Zool. iv., pl. xviii., p. 30.
Pagurus ,, Fabr., Suppl. Ent. Syst., p. 411.—Bell, Brit. Crust. p. 171.
Pagurus streblonyx, Leach, Malac. Brit. pl. xxvi., figs. 1-4.
,, ulidianus, W. Thompson, Rep. Brit. Assoc., 1843, p. 267.—Bell, Brit. Crust. p. 180 *(a dwarf var.)*.
Eupagurus Bernhardus, Brandt, Middend. Sibir. Reise, Zool. i. p. 105.

Abundant everywhere from between tidemarks down to considerable depths. It is frequently infested by the following parasites: a *Bopyrus* in the branchial chamber, *Phryxus paguri* and *Peltogaster paguri* on the abdomen. A specimen taken in Kilbrannan Sound, 75-80 fathoms, mud, had three of the last named attached to it. The shells tenanted by this species, when living between tidemarks or in shallow water, are frequently covered by *Hydractinia echinata*, a hydroid which appears to show a marked preference for this hermit-crab, though we have also taken it rarely along with *E. pubescens*.

EUPAGURUS PRIDEAUXII.

Pagurus Prideauxii, Leach, Malac. Brit. pl. xxvi., figs. 5, 6.—Bell, Brit. Crust. p. 175.
Pagurus solitarius, Risso, Hist. Nat. de l'Eur. mér. t. v., p. 40.
Eupagurus Prideauxii, Heller, Crust. des Südl. Eur. p. 161, taf. v., figs. 1-8.

Common almost everywhere, from low water down to 20 fathoms. In the Firth of Clyde it is always found associated with the anemone, *Adamsia palliata*. Individuals frightened out of their original shells in the hurry and commotion of the dredge

are frequently obtained, and some of these were noticed to take possession of other empty shells which had come up in the same haul. This fact may explain some of the supposed cases of *E. Prideauxii* living without *Adamsia*. We found that naked specimens, when placed in a jar of water with a number of conveniently-sized shells, one of which had an *Adamsia*—previously deprived of its hermit—invariably selected the latter. It is perhaps the most brilliantly-coloured British pagurid, and some stress may be laid on the fact that the same statement also applies to the anemone. In our experience young specimens are very rarely obtained, as we only met with one, which measured about half-an-inch in length, and was located in a shell of *Trochus tumidus*, yet even at this early stage furnished with a very small *Adamsia*. We took females with ova in March and August. A *Bopyrus* is occasionally found in the branchial chambers.

EUPAGURUS PUBESCENS.

Pagurus pubescens, Kröyer, Conspect. Crust. Groenl. Naturh. Tidsskr. ii., p. 251.

Pagurus Thompsoni, Bell, Brit. Crust. p. 372.

Eupagurus pubescens, Stimpson, Proc. Acad. Nat. Sc. Phil., 1858, p. 75.

Eupagurus Kroyeri, Stimpson, Ann. Lyc. Nat. Hist. vol. vii., p. 89 *(var.)*.

Common in 5-35 fathoms on hard ground, in many localities as far up as the Gareloch; especially abundant and fine on the Skelmorlie Bank. The variety with the chelipedes and limbs almost destitute of hairs *(E. Kroyeri*, Stim.*)* also occurs along with the type. This species frequently inhabits shells which are completely enveloped by the sponge *Hymeniacidon suberea*, Bow., though *E. Bernhardus* is also occasionally found in the same situation.

EUPAGURUS CUANENSIS.

Pagurus cuanensis, Thompson, Brit. Assoc. Rep., 1843, p. 267. —Bell, Brit. Crust., p. 178.

Eupagurus cuanensis, Stimpson, Proc. Acad. Nat. Sc. Phil., 1858, p 75.

Lamlash Bay and Cumbrae (Norman). In the upper laminarian zone Clachland Point, and dredged in Lamlash Bay (Herdman). We dredged it in shallow water off Portincross, off Cumbrae, and on the Skelmorlie Bank, but it does not appear to be a very common species in the Clyde.

Genus SPIROPAGURUS, Stimpson.

Spiropagurus, Stimpson, Proc. Acad. Nat. Sc. Phil., 1858, p. 74.

Subgenus ANAPAGURUS, nov.

Carapace depressed in front, the transverse suture very deep. Ocular peduncles short and stout, the corneæ dilated. Chelipedes unequal, the right larger. External antennae with long slender flagella which are usually ciliated, the acicle slender. Ambulatory legs long and slender. Males furnished with a short curved genital appendage attached to the coxa of the fifth left leg.

It differs from *Spiropagurus* in the form of the male sexual appendage, which is spirally coiled in the latter, and in the unequal chelipedes. In *Spiropagurus*, also, the ambulatory limbs, especially their meral joints, are more robust, and the dactyli are proportionately longer and ciliated. The external maxillipedes are also much shorter in *Anapagurus*. It is allied to *Catapagurus*, A. M. Edw. (= *Hemipagurus*, S. I. Smith), but in this genus the male appendage is attached to the coxa of the fifth *right* leg.

In the writer's forthcoming report on the "Challenger" Anomura, this subgenus will be more fully characterised, and new species described from the Canary Is., Cape of Good Hope, and Port-Jackson.

ANAPAGURUS HYNDMANNI.

Pagurus Hyndmanni, Thompson, Rep. Brit. Assoc., 1843, p. 267.—Bell, Brit. Crust., p. 182.

Eupagurus Hyndmanni, Stimpson, Proc. Acad. Nat. Sc. Phil., 1858, p. 74.

Firth of Clyde, fine in 10-15 fathoms on a muddy bottom (Norman). Off Cumbrae (Robertson).

ANAPAGURUS LAEVIS.

Pagurus laevis, Thompson, Rep. Brit. Assoc., 1843, p. 267.—Bell, Brit. Crust. p. 184.

Eupagurus laevis, Stimpson, Proc. Acad. Nat. Sc. Phil., 1858, p. 74.

Common and fine in many localities, in 10-105 fathoms, usually on muddy ground; at the latter depth, in Loch Fyne, we dredged a female with ova in August, and several of those taken in March were in a similar condition.

ANAPAGURUS FERRUGINEUS.

Pagurus ferrugineus, Norman, Ann. Mag. Nat. Hist., ser. 3, vol. viii., 1863, p. 273, pl. xiii., figs. 1-3.

Lamlash Bay, Feb. 1853 (Norman). We procured specimens in Lamlash Bay, off Portincross, off the Tan Buoy Cumbrae, and on the Skelmorlie Bank, on moderately hard ground, and at a depth of 5-20 fathoms. Females with ova in July. From its small size it is perhaps frequently passed over as the young of some other pagurid; when freshly taken it may however be recognised by the bright colour of the antennules, the stalks of which are red, while the flagella are a brilliant blue.

Subtribe GALATHEIDEA.

Family GALATHEIDAE.

Genus MUNIDA, Leach.

MUNIDA RUGOSA.

Galathea rugosa, Fabr., Suppl. Ent. Syst. p. 415, 2.—Leach, Malac. Brit. pl. xxix.

Astacus Bamfficus, Penn., Brit. Zool. iv., pl. xiii.

Galathea Bamffia, Leach, Edin. Ency. vii., p. 398.

Munida rugosa, Leach, Dict. des Sc. Nat. xviii., p. 52.—Heller, Crust. des Südl. Eur. p. 192, taf. vi., figs. 5, 6.

Munida Rondeletii, Bell, Brit. Crust. p. 208.

Common in all parts of the Firth as far up as the Gareloch, but usually in rather deep water. It is

specially common on the bank between the Cloch Light and Inverkip Bay; one specimen from this locality measures $4\frac{1}{2}$ inches from tip of rostrum to telson, and including chelipedes, $10\frac{1}{2}$ inches; another has the rostral spine completely twisted to one side. Among a large number of specimens only a single female occurred with ova, taken in the deepest part of Loch Fyne in August.

Genus GALATHEA, Fabr.

GALATHEA SQUAMIFERA.

Galathea squamifera, Leach, Edin. Ency. vii., p. 393.—Bell, Brit. Crust. p. 197.

Galathea Fabricii, Leach, Ency. Brit. Supp. pl. xxi.

Common under stones at low-water, Cumbrae (Norman, Robertson, *et nobis*). Lamlash Bay, dredged and between tide-marks (Herdman). We took a single specimen in shallow water off Fairlie. With ova in July.

GALATHEA STRIGOSA.

Cancer strigosus, Linn., Syst. Nat. xii., 1053.

Astacus ,, Penn., Brit. Zool. iv., p. 24, pl. xv.

Galathea strigosa, Fabr., Suppl. Ent. Syst. p. 414.—Bell, Brit. Crust. p. 200.

Galathea spinigera, Leach, Malac. Brit. pl. xxviii. B.

Cumbrae, under stones at low-water during spring tides (Robertson). We dredged several young specimens off Roseneath Point, 15 fathoms, hard ground.

GALATHEA NEXA.

Galathea nexa, Embleton, Proc. Berwickshire Nat. Field Club. —Bell, Brit. Crust. p. 204.

Loch Fyne, 20-70 fathoms (M'Andrew). Off the Tan, Cumbrae, 7-8 fathoms, gravelly mud (Robertson). Lamlash Bay (Herdman). We took fine specimens on the Skelmorlie Bank, off Wemyss Bay, and off Cumbrae, in 6-40 fathoms.

GALATHEA DISPERSA.

Galathea dispersa, Spence Bate, Proc. Linn. Soc. Zool. vol. iii., p. 3.

Common as far up as the Gareloch, usually on hard ground in 10-40 fathoms. Many females with ova in March. It is apparently the commonest and most generally distributed *Galathea* in the Firth of Clyde. A *Bopyrus* is frequently found in the branchial chamber, and *Sacculina* occurs rarely on the abdomen.

This species is very closely allied to *G. nexa*, and we believe that subsequent examination may show it to be only a well-marked variety, or possibly founded on the females and young males of the latter.

GALATHEA INTERMEDIA.

Galathea intermedia, Lilljeborg, Öfvers Vet. Acad. Förhandl., 1851, p. 21.

Galathea Andrewsii, Kinahan, Nat. Hist. Rev. vol. iv., pt. 2, p. 228; Irish Acad. Trans. xxiv., 1871, p. 95.

Common on hard ground, 10-20 fathoms, in many parts of the Firth, as far up as the Gareloch. Females with ova in July. A *Bopyrus* is occasionally present in the branchial chamber.

MACRURA.

Subtribe THALASSINIDEA.

Family GEBIDAE.

Genus Calocaris, Bell.

CALOCARIS MACANDREAE.

Calocaris Macandreae, Bell, Brit. Crust. p. 233.

This interesting species was originally described in the *British Stalk-eyed Crustacea* from specimens taken by M'Andrew in Loch Fyne. We dredged it there at depths of 40 and 105 fathoms, on a muddy bottom, and Mr. Brook obtained it off Tarbert. It also occurred sparingly off Wemyss Bay, 40 fathoms, and several miles off Brodick Bay, 93 fathoms, in both instances on soft ground.

The colour of living specimens is a beautiful flesh tint deeper on the abdomen, with the limbs white,

except the terminal joints of the chelipedes which are flesh-coloured. The eyes have a peculiar yellowish tinge. One of our Loch Fyne specimens, and both of those taken off Wemyss Bay, had the carapace and limbs bristling with an interesting polyzoon—*Triticella Korenii*, Sars—which is only recorded in Hinck's *British Polyzoa*, from doubtful specimens taken on *Sacculina*, off Oban, by Rev. Dr. Norman.

Subtribe ASTACIDEA.

Family PALINURIDAE.

Genus PALINURUS, Fabr.

PALINURUS VULGARIS.

Cancer (Astacus) homarus, Penn., Brit. Zool. iv., p. 16, pl. xi., fig. 22.

Palinurus quadricornis, Fabr., Suppl. Ent. Syst. p. 401.

,, homarus, Leach, Edin. Ency. vii., p. 397.

,, vulgaris, Latr. Ann. du Mus. iii., p. 391.—Bell, Brit. Crust. p. 213.

Off Campbeltown (Martin). Mr. Brook obtained a single specimen in Loch Fyne. It is occasionally seen in fishmongers' shops in Glasgow.

Family ASTACIDAE.

Genus HOMARUS, Milne Edwards.

HOMARUS GAMMARUS.

Cancer gammarus, Linn., Fauna Suec. 2033.

Astacus marinus, Fabr., Suppl. Ent. Syst. p. 406.—Penn, Brit. Zool. iv., pl. x., fig. 21.

Homarus vulgaris, M. Edw., Hist. Nat. des Crust. ii., p. 334.—Bell, Brit. Crust. p. 242.

Still common on the rocky shores near the mouth of the Firth, though the demand for this species as an article of food has sadly thinned its numbers within recent years.

Genus NEPHROPS, Leach.

NEPHROPS NORVEGICUS.

Cancer norvegicus, Linn., Syst. Nat. i., 1058.

Astacus ,, Fabr., Ent. Syst. p. 418. — Penn., Brit. Zool. iv., p. 23, pl. xiii., fig. 1.

Nephrops norvegicus, Leach, Edin. Ency. vii., p. 400.—Bell, Brit. Crust. p. 251.

Common in many localities, especially towards the mouth of the Firth, in 20-60 fathoms. Being a quick swimmer, trawling must be resorted to for its capture, and it is rarely taken in the dredge; we, however, obtained a small specimen by the latter method near the head of the Gareloch.

Subtribe CARIDEA.

Family CRANGONIDAE.

Genus Crangon, Fabr.

CRANGON VULGARIS.

Astacus crangon, Herbst, Krabben und Krebse, t. ii., p. 57, pl. xxix., figs. 3, 4.—Penn., Brit. Zool. iv., pl. xv., fig. 30.

Crangon vulgaris, Fabr., Suppl. Ent. Syst. p. 410.—M. Edw., Hist. Nat. des Crust. ii., p. 341.—Bell, Brit. Crust. p. 256.

Common on all the sandy shores, and in shallow water as far up as the Gareloch. In the Firth of Clyde it is probably nowhere sufficiently abundant to be profitably "shrimped" for the market.

CRANGON SPINOSUS.

Crangon spinosus, Leach, Trans. Linn. Soc. xi., p. 346.—Bell, Brit. Crust. p. 261.

Crangon cataphractus, M. Edw., Hist. Nat. des Crust. ii., p. 243.—White, List Crust. Brit. Mus. p. 74.

Pontophilus spinosus, Leach, Malac. Brit. pl. xxxvii., A.—M. Sars, Bidrag til Kundskab om Christianiafjordens Fauna i., p. 2.

Not uncommon in many localities as far up as the Cloch Light, 20-60 fathoms, usually on soft ground. One specimen had a curious parasite attached to the mouth organs, which the Rev. Dr. Norman regards as new.

CRANGON SCULPTUS.

Crangon sculptus, Bell, Brit. Crust. p. 263.—Heller, Crust. des Südl. Eur. p. 228, taf. vii., fig. 11.

Lamlash Bay, 5 fathoms, sand, two specimens (Norman). We dredged a single specimen off Muggie Point Little Cumbrae, 20 fathoms, hard ground.

CRANGON NANUS.

Crangon nanus, Kröyer, Nat. Tidssk. iv., p. 231.

Pontophilus bispinosus, Hailstone, Mag. Nat. Hist. viii., pp. 11, 13, fig. 30.

Crangon bispinosus, Bell, Brit. Crust. p. 268.

Off Cumbrae (Robertson).

CRANGON ALLMANI.

Crangon Allmani, Kinahan, Proc. Dublin Nat. Hist. Soc. 1857, vol. iv., p. 80; Irish Acad. Trans. xxiv., 1871, p. 65.—White, Pop. Hist. Brit. Crust. p. 334.

Abundant everywhere in deep water, usually on soft ground, in 20-105 fathoms. We took females with ova in Loch Fyne in the month of July.

CRANGON ECHINULATUS.

Crangon echinulatus, M. Sars, Videnskabs Selsk. Förhandl., 1861, p. 186.

Crangon serratus, Norman, Brit. Assoc. Rep., 1861 (1862), p. 151.

A single specimen off Skate Is. Loch Fyne, 105 fathoms, mud. This species had only previously been taken in Britain by Dr. Norman off the Shetland Is. in 1861 and 1867, and off the Hebrides in 1866.

Genus NIKA, Risso.

NIKA EDULIS.

Nika edulis, Risso, Crust. de Nice, p. 85, pl. iii., fig. 3.—M. Edw., Hist. Nat. des Crust. ii., p. 364.—Bell, Brit. Crust. p. 275.

Processa canaliculata, Leach, Malac. Brit. pl. xli.

,, edulis, Latr. Reg. Anim. de Cuv. (2e éd.) iv., p. 95.

Nika canaliculata, Desmarest, Consid. sur les Crust. p. 231, pl. xxxix., fig. 4.

Several specimens off Skate Is., 105 fathoms, Aug. 1885, with the last species; one—a female with ova—measures $2\frac{13}{16}$ inches in length; also a solitary specimen off Brodick Bay, 93 fathoms, mud.

The colour during life is white, with a yellowish-brown tinge, the latter due to the presence of small pigment spots over the body, limbs, and stalks of the antennæ; the eyes a beautiful bluish gray. The remarkable translucency of the body has been frequently noticed by writers; in our specimens the

viscera were distinctly visible, and in one the pulsations of the heart—amounting to about sixty in the minute—could be distinctly made out.

Family PALAEMONIDAE.

Genus HIPPOLYTE, Leach.

HIPPOLYTE CRANCHII.

Hippolyte Cranchii, Leach, Malac. Brit. pl. xxxviii., figs. 17-21. —M. Edw., Hist. Nat. des Crust. ii., p. 376.—Bell, Brit. Crust. p. 288.

Hippolyte crassicornis, M. Edw., Hist. Nat. des Crust. ii., p. 375.

Hippolyte mutila, Kröyer, Monogr. Fremstilling af Hippol. Nord. Arter, p. 86.

Hippolyte Yarrelli, Thompson, Ann. Mag. Nat. Hist., 1853, ser. 2, vol. xii., p. 112, pl. vi., fig. 2 (*var.*).

Loch Fyne (Forbes and M'Andrew). Off Cumbrae; also off Craigmore, and Hawk's Neb, Bute, 5-20 fathoms hard ground, not common. A female with ova in July. One specimen with a *Phryxus* adhering to the abdomen.

HIPPOLYTE GAIMARDII.

Hippolyte Gaimardii, M. Edw., Hist. Nat. des Crust. ii., p. 378.
Hippolyte pandaliformis, Bell, Brit. Crust. p. 294.

Described by Bell from examples dredged by Prof. Edward Forbes and Mr. M'Andrew in Loch Fyne. It is not uncommon in many localities from Lamlash Bay to near the head of Loch Goil, in 5-45 fathoms, on both hard and soft bottoms; at the latter depth, near Ardentinny, Loch Long, we obtained upwards of thirty specimens in a single haul. The toothing of the rostrum does not appear to be very constant, the formula being $\frac{5\text{-}8}{4\text{-}7}$; the apex occasionally—by no means invariably—bidentate.

HIPPOLYTE PUSIOLA.

Hippolyte pusiola, Kröyer, Monogr. Fremstilling af Hippol. Nord. Arter, p. 111.

Hippolyte Andrewsii, Kinahan, Nat. Hist. Rev., 1857.

,, Barleei, Bate, Ann. Mag. Nat. Hist., 1852, vol. x., p. 357, pl. v. B., fig. 1.

Off Cumbrae (Robertson). We obtained a few specimens in Loch Goil and Loch Long, 20-35 fathoms, mud.

HIPPOLYTE SECURIFRONS.

Hippolyte securifrons, Norman, Trans. Tyneside Nat. Field Club, 1863, vol. iv., p. 267, pl. xii., figs. 1-7.

Hippolyte Lilljeborgi, Dan. og Boeck., Beskrivelse of nogle Norske Crust. Decap. 1872, p. 8.

Abundant and fine in 25-100 fathoms, usually on soft ground, as far up as Loch Long. A single female with ova in March. *Phryxus abdominalis* frequently occurs on the abdomen.

This species when alive is of a beautiful red colour. It is closely allied to *H. spinus* (Sowerby), but in the latter the rostrum commences almost at the posterior border of the carapace, and its teeth are minutely serrated, the prolongation of the third abdominal segment is more acute, and the spiny armature of the telson is different. We have never taken *H. spinus* in the Clyde. The rostral formula of *H. securifrons* is $\frac{10\text{-}13 \text{ rarely } 14}{3\text{-}4 \text{ rarely } 5}$.

Genus VIRBIUS, Stimpson.

Virbius, Stimpson, Proc. Acad. Nat. Sc. Phil., 1860, p. 104.

VIRBIUS VARIANS.

Hippolyte varians, Leach, Edin. Ency. viii., p. 432.—Bell, Brit. Crust. p. 286.

Hippolyte smaragdina, Kröyer, Monogr. Fremstilling af Hippol. Nord. Arter., p. 63.

Virbius smaragdinus, Stimpson, Proc. Acad. Nat. Sc. Phil., 1860, p. 104.

Virbius varians, Heller, Crust. des Südl. Eur. p. 288, taf. x., fig. 4.

Common in rock pools at low-water, and in the laminarian zone, especially towards the mouth of the Firth.

VIRBIUS PRODUCTUS.

Hippolyte producta, Norman, Ann. Mag. Nat. Hist. ser. 3, vol. viii., 1861, p. 275, pl. xiii., fig. 5.

Lamlash Bay, a single specimen (Norman).

Genus CARIDION, Göes.

Doryphorus, Norman, Ann. Mag. Nat. Hist., 1861, p. 277.
Caridion, Göes, Crust. decap. mar. Sueciae, 1863, p. 170.

This genus was first characterized by the Rev. Dr. Norman, but his name—*Doryphorus*—being pre-occupied in zoology, that of *Caridion* was substituted by Göes.

CARIDION GORDONI.

Hippolyte Gordoni, Bate, Nat. Hist. Rev., 1858, vol. v. p. 51.
Doryphorus ,, Norman, Ann. Mag. Nat. Hist., 1861, p. 277, pl. xiii., figs. 6, 7.
Caridion Gordoni, Göes, Crust. decap. mar. Sueciae, Öfvers Vet. Acad. Förh., 1863, p. 170.

Lamlash Bay, two specimens, 1853 (Norman). Not uncommon throughout the Firth, especially in deep water; our largest specimen measures $1\frac{1}{4}$ inches in length, and was taken near the head of Loch Goil, in 5-10 fathoms. Females with ova in March. The toothing of the rostrum is tolerably constant, the formula being $\frac{6\text{-}8}{1}$.

Genus PANDALUS, Leach.

PANDALUS ANNULICORNIS.

Pandalus annulicornis, Leach, Malac. Brit. pl. xl.—M. Edw., Hist. Nat. des Crust. ii., p. 384.—Bell, Brit. Crust. p. 297.

Abundant and fine everywhere in 30-105 fathoms, on a muddy bottom; smaller specimens common in shallow water in all parts of the Firth. Many examples from deep water, especially those taken in Loch Fyne, have the beautiful red tinge so characteristic of deep-sea crustacea. The toothing of the rostrum varies considerably in different individuals; in a large number which we examined for the purpose we found it $\frac{8\text{-}9 \text{ rarely } 10.}{5\text{-}8.}$. Several of our largest specimens measure $4\frac{1}{2}$ inches in length. *Phryxus abdominalis* occurs not infrequently on the abdomen, and a *Bopyrus* is occasionally found in the branchial chamber.

PANDALUS BREVIROSTRIS.

Pandalus brevirostris, Rathke, Acta Acad. Leop. t. xx., p. 17.

Hippolyte Thompsoni, Bell, Brit. Crust. p. 290.

Pandalus Jeffreysi, Bate, Nat. Hist. Rev. vol. vi., p. 100.

,, Thompsoni, Norman, Ann. Mag. Nat. Hist., 1861, p. 279, pl. xiv., figs. 3-9.

Common almost everywhere as far up as the Gareloch, in 5-40 fathoms, usually on hard ground. The majority of the females taken in March were with ova, and we also found some in a similar condition in July. The toothing of the rostrum is remarkably constant, the formula deduced from a large number of specimens being $\frac{7-8}{2-3}$, the teeth on the lower border always very minute. A small *Bopyrus* is occasionally found in the branchial chamber.

Genus PALAEMON, Fabr.

PALAEMON SQUILLA.

Cancer squilla, Linn. Syst. Nat. i., 1051.

Palaemon squilla, Fabr., Suppl. Ent. Syst. p. 403.—M. Edw., Hist. Nat. des Crust. ii., p. 390.—Bell, Brit. Crust., p. 305.

Palaemon elegans, Rathke, Mém. prés à l'Acad. de St. Petersb., 1837, t. iii.

Common in rock pools at and below half-tide, in many localities towards the mouth of the Firth; occasionally dredged in shallow water. We obtained specimens from a depth of 20 fathoms in Kilchattan Bay, Bute.

Genus PALAEMONETES, Heller.

Palaemonetes, Heller. Zeitschr. f. wissensch. Zool., B. xix., p. 156.

PALAEMONETES VARIANS.

Palaemon varians, Leach, Edin. Ency. vii., pp. 401, 431.—Bell, Brit. Crust. p. 309.

Palaemon antennarius, M. Edw., Hist. Nat. des Crust. ii., p. 391.

Palaemon lacustris, Martens, Archiv. f. Naturg., 1857, p. 183, taf. x.

Anchistia migratoria, Heller, Crust. des Südl. Eur. p. 259, taf. viii., fig. 20.

Palaemonetes varians, Heller, Zeitschr. f. wissensch. Zool. B. xix., p. 156.

Cumbrae, at low water (Robertson).

Family PASIPHAEIDAE.

Genus PASIPHAEA, Savigny.

PASIPHAEA SIVADO.

Alpheus sivado, Risso, Crust. de Nice p. 93, tab. iii., fig. 4.
Pasiphaea ,, Risso, Hist. Nat. de l'Eur. Mér. v., p. 81.—M. Edw., Hist. Nat. des Crust. ii., p. 426.—Bell, Brit. Crust. p. 312.
Pasiphaea Savignyi, M. Edw., Hist. Nat. des Crust. ii., p. 426.
,, brevirostris, M. Edw., *l.c.* p. 426.

Four specimens off Skate Is., Loch Fyne, 105 fathoms, mud; one of these measures 4 inches in length, and two others are scarcely inferior in size. During life they were translucent and of a pinkish white colour, mottled with red on the limbs, abdominal segments, and telson.

SCHIZOPODA.

Family EUPHAUSIIDAE.

Genus NYCTIPHANES, G. O. Sars.

Nyctiphanes, G. O. Sars, Prelim. Notices Challenger Schizopoda, Christiania Vidensk.-Selsk. Förhandl., 1883, No. 7, p. 23.

NYCTIPHANES NORVEGICA.

Thysanopoda norvegica, M. Sars, Videnskabs Selsk. Förhandl., 1863, p. 2.
Nyctiphanes norvegica, G. O. Sars, *l.c.* p. 23, 1883.

Abundant and fine everywhere in deep water, on a muddy bottom, as far up as Loch Goil; more rarely in shallow water, under 20 fathoms. The great majority of our specimens were taken on the bottom, very few occurring in the deep tow-nets, and only a few small and immature forms in the surface-net at night. We are inclined to think that this species may prove to be a true bottom form, spending its existence in the surface waters up to a comparatively advanced stage of growth. Young specimens are not uncommon in the Firth of Forth at the surface, especially in winter and spring; and it was taken abundantly in the same condition by Mr. Murray during the cruise of H.M.S. "Triton" in

the Faroe Channel. By means of the shrimp trawl, we took, towards the mouth of the Firth of Clyde, as many as one hundred specimens in a single haul, the majority averaging 1½ inches in length.

In living specimens the eyes have black corneæ. The body is white and translucent, faintly tinged with pink; the anterior part of the carapace and the ambulatory limbs mottled with reddish spots. The "phosphorescent organs" are carmine red in colour.

Genus Boreophausia, G. O. Sars.

Boreophausia, G. O. Sars, Prelim. Notices Challenger Schizopoda, Christiania Vidensk.-Selsk. Förhandl., 1883, No. 7, p. 11.

BOREOPHAUSIA RASCHII.

Thysanopoda Raschii, M. Sars, Videnskabs Selsk. Förhandl., 1863, p. 14.

Several specimens in a tow-net attached to trawl, from the channel between Little Cumbrae and Bute, at a depth of 60 fathoms, on a muddy bottom. A single specimen also dredged in Loch Long opposite the mouth of Loch Goil, 45 fathoms, mud: an interesting addition to the British fauna; we had, however, previously taken specimens in the Firth of Forth in November, 1884.

Family MYSIDAE.

Genus Mysidopsis, G. O. Sars.

Mysidopsis, G. O. Sars, Beretning om en i Sommeren, 1863, foretagen Zoologisk Reise, p. 27.

MYSIDOPSIS DIDELPHYS.

Mysis didelphys, Norman, Brit. Assoc. Rep., 1862, p. 118; Trans. Tyneside Nat. Field Club, vol. v., p. 270, pl. xii., figs. 9-11.

Mysidopsis didelphys, G. O. Sars, Beretning om en i Sommeren, 1863, foretagen Zoologisk Reise, p. 27; Monogr. Norges Mysider (2), 1872, p. 20, pl. vii.

Two specimens taken off the Cloch Light, 43 fathoms, mud.

MYSIDOPSIS GIBBOSA.

Mysidopsis gibbosa, G. O. Sars, Beretning om en i Sommeren, 1863, foretagen Zoologisk Reise, p. 28; Monogr. Norges Mysider (2), 1872, p. 23, pl. viii., figs. 1-13.

Several specimens on a zostera-bed near low-water, Tarbert (Brook). Previously taken by the Rev. Dr. Norman off Valentia, in May 1878, though not hitherto recorded from the British coasts.

Genus LEPTOMYSIS, G. O. Sars.

Leptomysis, G. O. Sars, Undersögelser over Christianiafjordens Dybvandsfauna, p. 29, 1869.

LEPTOMYSIS LINGUARA.

Mysis linguara, G. O. Sars, Beretning om en i Sommeren, 1865, foretagen Zoologisk Reise, p. 21.

Leptomysis linguara, G. O. Sars, Monogr. Norges Mysider (3), 1879, p. 35, tab. xxi.

A single specimen on the zostera-bed, Tarbert (Brook). Not previously recorded from Britain, though Dr. Norman informs us he has specimens from Cullercoats Northumberland, Seaham Co. Durham, and Starcross Devonshire (Parker).

Genus MYSIS, Latr.

MYSIS FLEXUOSA.

Cancer flexuosus, Müller, Zool. Dan. ii., p. 34, tab. lxvi., figs. 1-9.

Mysis spinulosus, Leach, Trans. Linn. Soc. xi., p. 350.

,, chamaeleon, J. V. Thompson, Zool. Researches, p. 28, pl. ii., fig. 1.—M. Edw., Hist. Nat. des Crust. iii., p. 457.—Bell, Brit. Crust. p. 336.

Mysis flexuosus, G. O. Sars, Monogr. Norges Mysider (3), 1879, p. 45, tab. xxiv., xxv.

Abundant everywhere in pools between tidemarks, and in the laminarian zone.

MYSIS LAMORNAE.

Mysis Lamornae (R. Q. Couch), Norman, Ann. Mag. Nat. Hist. ser. 3, vol. vi., pl. viii., figs. 4, 5.—Göes, Crust. decap. mar. Sueciae, p. 15.—G. O. Sars, Monogr. Norges Mysider (3), 1879, p. 65, tab. xxx.

Mysis aurantia, G. O. Sars, Beretning om en i Sommeren, 1863, foretagen Zoologisk Reise, p. 20.

On a sandbank at low-water, near Port-Glasgow (Robertson).

MYSIS VULGARIS.

Mysis vulgaris, J. V. Thompson, Zool. Researches, p. 30, t. i. —Bell, Brit. Crust. p. 339.—G. O. Sars, Monogr. Norges Mysider (3), 1879, p. 80, tab. xxxiv.

Prof. Bell suggests that the *Mysis integer* briefly described by Leach in the *Transactions of the Linnean Society*, vol. xi., p. 350, is probably identical with this species. In this paper it is stated that, "at low tide, near Loch Ranza (in the Isle of Arran), the pools were full of this species, swimming with its head uppermost, and its eyes spread, making a most grotesque appearance." We have never met with it in the district.

MYSIS NEGLECTA.

Mysis neglecta, G. O. Sars, Undersögelser over Christianiafjordens Dybvandsfauna, p. 37; Monogr. Norges Mysider (3), 1879, p. 51, tab. xxvi.

Mouth of Loch Fyne, 60 fathoms, mud; a single specimen from a tow-net attached to the trawl. Not previously recorded from the British coasts, though Dr. Norman has taken specimens in the Channel Is. between tidemarks.

MYSIS GRIFFITHSIAE.

Mysis Griffithsiae, Bell, Brit. Crust. p. 342.
? ,, rostratus, Guerin, Iconogr. Crust. t. xxiii., fig. 2.

In the surface-net at Cumbrae, rare (Robertson).

MYSIS PRODUCTUS.

Mysis productus, Gosse, Ann. Mag. Nat. Hist., 1853, p. 156, pl. vi., figs. 5 a-b.

Firth of Clyde (Robertson). This is a very imperfectly-characterized species.

MYSIS INERMIS.

Mysis inermis, H. Rathke, Beyträge zur Fauna Norvegens, p. 20.—G. O. Sars, Monogr. Norges Mysider (3), 1879, p. 54, tab. xxvii.

Mysis cornuta, Kröyer, Nat. Tidsskr. 3die Raekke i., p. 26, tab. i., fig. 3.

Mysis truncatula, G. O. Sars, Beretning om en i Sommeren, 1863, foretagen Zoologisk Reise, p. 16.

In the laminarian zone, Cumbrae. Mr. Brook took a single specimen on the zostera-bed, Tarbert.

MYSIS ARENOSA.

Mysis arenosa, G. O. Sars, Middelhavets Mysider, Arch. Math. og Naturvidensk, 1876, p. 16, tab. v., vi.

Several specimens on the zostera-bed near low-water, Tarbert (Brook). This species is a native of the Mediterranean, and has not hitherto been recorded from the British seas, though Dr. Norman has previously received specimens taken by Mr. Parker at Starcross, Devonshire.

Genus GASTROSACCUS, Norman.

Gastrosaccus, Norman, Rep. Brit. Assoc., 1868, p. 268.

GASTROSACCUS SPINIFER.

Mysis spinifera, Göes, Crust. decap. mar. Sueciae, p. 14.

Gastrosaccus sanctus, Norman, Rep. Brit. Assoc., 1867, p. 438; *l.c.* 1868, p. 268.

Gastrosaccus spinifer, Stebbing, Ann. Mag. Nat. Hist. ser. 5, vol. vi., 1880, p. 114, pl. iii.

Firth of Clyde (Robertson). This mysid is well figured and described by the Rev. T. R. R. Stebbing, who first pointed out that it is distinct from *Gastrosaccus sanctus* (Van Beneden), to which species it was doubtfully referred by Göes and Norman.

APPENDIX.

It is to be understood that all remarks made in the foregoing list have been founded on the examination of Clyde specimens, though they will probably also be found applicable to those from other localities. The classification adopted in the Decapoda is that of Prof. Dana in his great work on the Crustacea of the United States Exploring Expedition, and in the Schizopoda the arrangement of Prof. G. O. Sars has been followed.

The higher Crustacea probably spawn at least twice in the year, viz., in spring, and in summer or autumn, the exact period being determined by conditions such as abundance of food, temperature, &c. The month, therefore, in which a female is found with ova in one year may differ in the next, so that only an approximate idea of the season is obtainable.

Doubtful Clyde Species.

The presence of the following species in the Firth of Clyde requires further confirmation, and the grounds on which they have been admitted are not altogether satisfactory. One or two, at least, may be the result of an error in identification.

Maia squinado (Herbst).
Achaeus Cranchii (Leach).
Gonoplax angulata (Fabr.).
Ebalia Cranchii (Leach).
Palaemonetes varians (Leach).

Since the earlier part of the paper was written we have seen a specimen of *Pirimela denticulata* (Mont.), dredged by Mr. A. Somerville of Glasgow, in Gair Loch, West Ross-shire, a species unrecorded in our list of West Coast Crustacea.

The Rev. Dr. Norman, in a recently published list of the North Atlantic and Arctic Crustacea in his private collection (March, 1886), makes the following species synonymous:—

Pagurus ferrugineus, Norman, = *Spiropagurus (Anapagurus) chiroacanthus* (Lilljeborg).

Hippolyte cultellata, Norman, = *H. polaris* (Sabine).

Mysis Griffithsiae, Bell, = *Siriella armata*, M. Edw.

The latter names having priority must therefore be adopted.

Dr. Norman also names a new schizopod from the Clyde:—

Siriella Brooki, Norman.

Zostera-bed at low-water, Tarbert (Brook).

XXXV.

NOTES ON THE NEUROPTERA OF ROTHIEMURCHUS AND KINGUSSIE.

BY JAMES J. F. X. KING.

[Read 27th April, 1886.]

In the spring of last year I fixed upon the neighbourhood of Insh as my summer holiday resort, with the view of increasing my knowledge of the Neuropterous Fauna of the Rothiemurchus and Kingussie districts. I had previously spent vacations at Kingussie and Loch-an-Eilan, in the years 1875, 1877, and 1878, where I accumulated a considerable amount of material which I wished to supplement by collecting in fresh pastures and at a later period of the year. Altogether, I have spent about fifteen weeks in these districts, and visited a number of outlying localities which have produced many interesting species.

The conditions of the country are very favourable for the production of *Neuroptera*, there being no scarcity of lochs, rivers, burns, and marshes, at various levels from 700 to upwards of 3000 feet.

The Spey is of course the most important river that passes through these districts. In the neighbourhood of Kingussie, as well as near Aviemore, the bottom is gravelly, and river species of Caddis-flies occur in abundance; while near Insh the bottom is muddy, and these insects are therefore scarcely represented. The rivers next in importance are the Feshie and the Tromie, which run over a gravelly bottom throughout the greater part of their courses.

Loch Morlich, situated at the base of Cairngorm on the north-west side, at an elevation of about 1046 feet above sea-level, is over a mile in length by about five-eighths of a mile in breadth. It

nestles in a wood composed of fir, beech, alder, &c., which affords shelter to the insects after they have come to maturity in the loch. I have had some good collecting along the margin of this loch.

Giack shooting-lodge stands at the head of Glen Tromie, about 11 miles from Kingussie. In its neighbourhood are two lochs, one being further up the glen and the other below the lodge. At the former, Loch Bhradain, I have spent some very enjoyable days in collecting; and at the latter, Loch-an-t-Seilich (which, by the way, means "the loch of the willows," although I could not find any), a larger sheet of water, I had the good fortune to take two species of Caddis-flies which I had not previously captured in Scotland.

On the evening of July 27th, while driving down Glen Tromie from these lochs, I passed through a dense cloud of *Hydropsyche instabilis* which extended for upwards of five miles. With a single sweep of my large net I could take fifty or sixty specimens—a fair indication of the density of the cloud. I have never seen anything equal to it in size. I again drove down the glen on 31st July, but did not then see a single individual of this species. I may mention, however, that on the occasion when the insects were so numerous the evening was very lovely, with little wind and not too much heat, while on the latter occasion the air was rather cooler.

At Loch-an-Eilan, about 3½ miles from Aviemore station, I first made my acquaintance with *Limnophilus subcentralis*, an interesting addition to the British *Trichoptera*, which has since been recorded from two or three fresh localities. The loch is well known to ornithologists from the fact of its being now one of the few spots in this country where the Osprey, or Fishing Eagle, nests and brings forth its young. The people in the locality informed me that two young birds had been hatched a few weeks before I visited the district last year.

Loch Alvie was visited on one occasion only; from

its exposure to east winds I do not consider it a very favourable collecting-ground, although near it I took two species which I did not get elsewhere.

Loch Insh—a widening out of the River Spey rather than a "loch" as generally understood—was one of my favourite collecting-grounds. It is well wooded on one side, and sheltered nooks can always be found where insects are in plenty.

Baden Dubh, a fir wood between the Feshie and the Spey, produced many of the pine-loving species of *Trichoptera* and *Neuroptera-Planipennia*; among the latter I may mention the large *Hemerobius concinnus*, and *H. inconspicuus*. The fir woods above Balnaspich were also similarly productive.

One peculiar feature of the district was the abundance of the common juniper, from which many very interesting *Psocidæ* were taken by beating. I have never been in a locality where juniper abounded to such an extent. Besides giving shelter to my favourites, the junipers unfortunately afforded an ambush to myriads of small "midges" which emerged in thousands as soon as the sun had set, thereby rendering the entomologist's life a misery instead of a round of enjoyments such as few persons can dream of!

As a result of my labours, I may mention that I obtained about a half of the British *Neuroptera*, with the exception of the Dragon-flies of which I only took about an eighth, and the May-flies of which I captured over a third.

PSEUDO-NEUROPTERA.

PSOCIDÆ.

CLOTHILLA

PULSATORIA, L.—Common in houses.

PSOCUS

FASCIATUS, F.—This pretty species was common in fir woods near Insh, Loch-an-Eilan, and in Glen Feshie.

SEXPUNCTATUS, L.—Not uncommon in the larval state; a few imagos were taken towards the end of August.

BIFASCIATUS, Latr.—Common at Insh, Loch-an-Eilan, and in Glen Feshie.

STENOPSOCUS

IMMACULATUS, Ste.—Frequent near Insh.

CRUCIATUS, L.—Common near Insh.

CÆCILIUS

FLAVIDUS, Ste.—Frequent near Insh.

OBSOLETUS, Ste.—Very common everywhere on fir, juniper, &c.

PICEUS, Kolbe.—Common all over the district, but especially abundant in a little gully near Soillierie.

BURMEISTERI, Brauer.—Common all over the district.

PERIPSOCUS

PHÆOPTERUS, Ste.—Scarce at Loch-an-Eilan.

ELIPSOCUS

UNIPUNCTATUS, Müll.—Abundant near Insh, and in Glen More and Glen Feshie.

WESTWOODII, M'Lach.—Abundant everywhere.

HYALINUS, Ste.—Common at Insh, Loch-an-Eilan, and in Glen Feshie.

FLAVICEPS, Ste.—Frequent near Insh.

CYANOPS, Rostock.—Very common in all stages on juniper bushes in fir woods.

PERLIDÆ.

DICTYOPTERYX

MICROCEPHALA, Pict.—One specimen at Loch Morlich and another at a lochan 3500 feet up Braeriach.

CHLOROPERLA

GRAMMATICA, Poda.—Common by the side of every stream.

ISOPTERYX

BURMEISTERI, Pict.—An insect apparently identical with this species occurred in abundance by the side of every water.

CAPNIA

NIGRA, Pict.—One specimen at Loch Insh.

TÆNIOPTERYX

TRIFASCIATA, Pict.—The females were not uncommon at Loch Bhradain and Loch-an-t-Seilich.

LEUCTRA

GENICULATA, Ste.—Very common at Loch Alvie.

FUSCIVENTRIS, Ste.—Abundant at Loch Insh, Loch Alvie, and in Glen Feshie.

NEMOURA

VARIEGATA, Oliv.—One of the commonest of the *Perlidæ* at Insh, Glen More, Giack, and Loch Alvie.

CINEREA, Oliv.—Also a common species all over the district.
HUMERALIS, Pict.—Common.

Note.—Certain *Leuctræ* and *Nemouræ* remain undetermined.

EPHEMERIDÆ.

LEPTOPHLEBIA
MARGINATA, L.—Occurred in considerable numbers at Insh, Loch-an-Eilan, and Giack.

CÆNIS
DIMIDIATA, Ste.—Very common at Loch Alvie.

EPHEMERELLA
IGNITA, Poda.—Abundant at Loch Insh, Loch-an-Eilan, and Loch Morlich.

CLOEON
SIMILE, Eaton.—Abundant at Loch Insh, Loch-an-Eilan, Loch Morlich, Loch Alvie, and Giack.
RUSSULUM, Müll.—Occasionally taken at Loch Insh.

CENTROPTILUM
LUTEOLUM, Müll.—Common at Lochs Alvie, Morlich, and Insh, and in Glen Feshie.

BAETIS
PUMILUS, Burm.—Common at Insh, Giack, and Loch Morlich.

SIPHLONURUS
LACUSTRIS, Eaton.—Not common at Loch Morlich and Giack.

RHITHROGENA
SEMICOLORATA, Curt.—Abundant at Insh, Loch Alvie, Giack, and Glen Feshie.

HEPTAGENIA
SULPHUREA, Müll.—Rare at Loch Insh.

ECDYURUS
VENOSUS, F.—Common at Inch, Giack, Loch Morlich, and Loch-an-Eilan.
LATERALIS, Curt.—Not common at Loch Bhradain and Loch-an-t-Seilich.

ODONATA.

LIBELLULIDÆ.

SYMPETRUM
SCOTICUM, Don.—A few were seen hovering over a pool near the Bobbin Mill at Kinrara.

LIBELLULA
QUADRIMACULATA, L.—Not common on the moor above the village of Insh.

GOMPHIDÆ.

CORDULEGASTER
ANNULATUS, Latr.—Occasionally seen in the neighbourhood of Insh and Loch-an-Eilan.

ÆSCHNIDÆ.

ÆSCHNA
JUNCEA, L.—Common on the roads about Insh and Loch-an-Eilan.

AGRIONIDÆ.

PYRRHOSOMA
MINIUM, Harr.—Common at Loch-an-Eilan, Bobbin Mill at Kinrara, and along the banks of the Spey.

AGRION
CYATHIGERUM, Charp.—Common at the Bobbin Mill at Kinrara and elsewhere.

NEUROPTERA-PLANIPENNIA.

SIALIDÆ.

SIALIS
LUTARIA, L.—Common in the meadows about Insh and along the banks of the streams.

RAPHIDIIDÆ.

RAPHIDIA
MACULICOLLIS, Ste.—This species occurred in considerable numbers in the year 1877 on dead fir branches near Loch-an-Eilan.

OSMYLIDÆ.

SISYRA
FUSCATA, Fab.—Very common at Loch-an-Eilan, Loch Insh, and Loch Morlich.

HEMEROBIIDÆ.

MICROMUS
PAGANUS, L.—Only one female occurred of this common species near Insh.

HEMEROBIUS
INCONSPICUUS, M'Lach.—Very common at Insh, Glen More, and Loch-an-Eilan; the male was rather scarce.
NITIDULUS, Fab.—Common at Insh, Loch-an-Eilan, Glen More, and Glen Feshie.
MICANS, Oliv.—Not common near Insh.
OROTYPUS, Wall.—Very common in Baden Dubh and about Loch-an-Eilan.
sp. ? Occurred at Wester Craigs.
MARGINATUS, Ste.—This species was very local, and only occurred in a little plantation of birch, alder, &c., to the south of Insh. During the twilight it flew rather quickly from tree to tree, and might then be taken pretty freely. I did not see it during the day, although working the locality.

LIMBATUS, Wesm.—Not uncommon at Baden Dubh, Loch-an-Eilan, and Loch Morlich.

ATRIFRONS, M'Lach.—Not uncommon at Baden Dubh and Loch-an-Eilan.

NERVOSUS, Fab.—Frequent at Baden Dubh, Loch Morlich, and Loch-an-Eilan.

CONCINNUS, Ste.—Several specimens of this fine insect were taken at Baden Dubh, Wester Craigs, and Giack. This species varies very much in colour; some of the specimens taken were of a rich light brown, while others were of the more common black form. These colour-forms occurred in both sexes.

CHRYSOPIDÆ.

CHRYSOPA

FLAVA, Scop.
VITATTA, Wesm. } —One male of each of these species was taken near Insh.

CONIOPTERYGIDÆ.

CONIOPTERYX

PSOCIFORMIS, Curt.—Several of these were taken near Insh and in Glen Feshie.

TINEIFORMIS, Curt.—Abundant near Insh and in Glen More.

PANORPIDÆ.

PANORPA

GERMANICA, L.—Common near Loch-an-Eilan.

TRICHOPTERA.

Inæquipalpia.

PHRYGANEIDÆ.

PHRYGANEA

STRIATA, L.—Males not uncommon at Insh, Giack, and Kingussie.

VARIA, F.—Very common in favourable localities, such as the meadows at Insh, where hundreds might be shaken out of a single alder tree.

OBSOLETA, (Hag.) M'Lach.—A few specimens were taken at Loch Bhradain.

LIMNOPHILIDÆ.

COLPOTAULIUS

INCISUS, Curt.—Common near Insh. Some of the males were remarkable for their very small size, measuring less than 12mm. across the wings.

GRAMMATAULIUS

ATOMARIUS, F.—Very common under the bark of palings, &c., in the meadows near Insh. A number of strange forms occurred. In some specimens the dark dorsal streak is quite black. This species was also taken near Loch-an-Eilan.

GLYPHOTÆLIUS

PELLUCIDUS, Oliv.—Not uncommon in 1877 among the bushes along Spey-side near Aviemore.

LIMNOPHILUS

RHOMBICUS, L.—Occasionally taken near Insh, Giack, Kingussie, and Loch-an-Eilan.

SUBCENTRALIS, Brauer.—Although careful search was made for this species I could not discover it in any number; odd specimens were taken at various places near Loch-an-Eilan and Insh.

MARMORATUS, Curt.—Very common all over the district. The pterostigma in some of the specimens is almost without colour, while in others it is almost as dark as in typical specimens of *L. xanthodes*.

STIGMA, Curt.—Scarce at Giack.

XANTHODES, M'Lach.—Well marked specimens occurred at Loch Insh.

LUNATUS, Curt.—Very common all over the district. Some exceptionally dark females occurred at Giack, while some very pale varieties were taken at Loch Morlich, Loch an-Eilan, and Loch Insh.

IGNAVUS, (Hag.) M'Lach.—A few specimens were taken in Glen Feshie by beating.

CENTRALIS, Curt.—Common at Insh, Loch Morlich, Giack, Loch-an-Eilan, and Kingussie.

VITTATUS, F.—Not uncommon at Insh and Giack. Four males from Giack are remarkable alike for their dark colour and a well-defined pterostigma in the posterior wings.

AURICULA, Curt.—Exceedingly abundant in the fir woods round Insh, Loch-an-Eilan, &c. Very variable in size and colour.

GRISEUS, L.—Not uncommon in the fir woods near Insh and Loch-an-Eilan.

EXTRICATUS, M'Lach.—Not uncommon in Baden Dubh and Glen Feshie.

LURIDUS, Curt.—Not uncommon at Insh, Glen More, Loch-an-Eilan, and Kingussie.

SPARSUS, Curt.—Exceedingly abundant. Some of the males are very small and light in colour, while many of the females are exceptionally large and almost black.

FUSCICORNIS, Ramb.—One female at Spey-side under bark.

STENOPHYLAX

STELLATUS, Curt.—Not uncommon at Giack, Kingussie, and Loch-an-Eilan.

HALESUS

RADIATUS, Curt.—Scarce at Loch Morlich.

AURICOLLIS, Pict.—Very abundant along the burn between Loch Bhradain and Loch-an-t-Seilich. It is worthy of note that this species (both sexes) was taken very freely on 27th July. I believe this to be the earliest date when it has been captured, the species being considered a late autumn one.

DRUSUS

ANNULATUS, Steph.—Not uncommon at a little burn which runs into Loch Morlich, also at Giack and Loch-an Eilan.

APATANIA

WALLENGRENI, M'Lach.—A few specimens were taken by sweeping the rough herbage at one spot on the side of Loch-an-t-Seilich.

SERICOSTOMATIDÆ.

SERICOSTOMA

PERSONATUM, Spence.—Not uncommon at Insh, Loch Morlich, Giack, and Kingussie.

SILO

PALLIPES, F.—Common all over the district.

CRUNŒCIA

IRRORATA, Curt.—Frequent at Loch-an-Eilan.

LEPIDOSTOMA

HIRTUM, Curt.—Very common at Insh, Loch Morlich, and Giack. The females varied very much in size, measuring across the wings from 14½ to 21½ mm.

LASIOCEPHALA

BASALIS, Kol.—Rather uncommon; a few specimens occurred at Loch Insh and Loch-an-Eilan.

Æquipalpiæ.

LEPTOCERIDÆ.

BERÆA

MAURUS, Curt.—Not uncommon at Inch, Giack, and Loch-an-Eilan.

ODONTOCERUM

ALBICORNE, Scop.—Scarce at Insh and Loch-an-Eilan.

LEPTOCERUS

NIGRO-NERVOSUS, Retz.—Spey-side, Loch Insh, Uath Lochan, &c.; occurred in single specimens over a wide area.

FULVUS, Ramb.—A few specimens occurred at Loch Morlich and Loch Insh.

ANNULICORNIS, Steph.—Very abundant at Loch Insh and on the river below, flying about sunset.

ATERRIMUS, Steph.—The black and brown forms were very common at all the lochs.

CINEREUS, Curt.—Very common at all the lochs and lochans. Some of the males are very large.

ALBIFRONS, L.—Scarce at Loch Insh and Loch-an-Eilan.

COMMUTATUS, (Rostock) M'Lach.—A few specimens were taken at Loch Insh and Giack.

BILINEATUS, L.—Not common at Loch Insh and in Glen More.

DISSIMILIS, Steph.—Common at Loch-an-Eilan and in Glen More.

MYSTACIDES

AZUREA, L.—Very common wherever there was standing water.

TRIÆNODES

BICOLOR, Curt.—Occurred sparingly at Insh and Loch-an-Eilan.

ŒCETIS

LACUSTRIS, Pict.—In numbers on the river below Loch Insh.

TESTACEA, Curt.—Not uncommon in fir woods, also near all the lochs in the district.

HYDROPSYCHIDÆ.

HYDROPSYCHE

PELLUCIDULA, Curt.—At Loch-an-Eilan.

INSTABILIS, Curt.—Loch-an-Eilan and Glen Tromie.

GUTTATA, Pict.—Near Loch-an-Eilan.

PHILOPOTAMUS

MONTANUS, Donov.—Not common at Loch Insh, Loch-an-Eilan, and Kingussie.

WORMALDIA

SUBNIGRA, M'Lach.—Common in Glen Tromie.

NEURECLIPSIS

BIMACULATA, L.—Extremely abundant on the river below Loch Insh, also very common at a small burn which flows into Loch-an-Eilan.

PLECTROCNEMIA

CONSPERSA, Curt.—Males not uncommon at Insh, Giack, Loch-an-Eilan, and Kingussie.

GENICULATA, M'Lach.—A male of this scarce species was taken at Giack.

POLYCENTROPUS

FLAVO-MACULATUS, Pict.—As usual this species was very abundant all over the district. A few specimens of a pale golden colour were taken at Loch Morlich. A female, presumably of this species, has the third apical fork present in the posterior wings.

MULTIGUTTATUS, Curt.—A male was taken at Insh.

HOLOCENTROPUS

DUBIUS, Ramb.—Not uncommon at Insh and Loch-an-Eilan.

PICICORNIS, Steph.—A few specimens were taken near Insh.

CYRNUS

TRIMACULATUS, Curt.—Very common everywhere.

FLAVIDUS, M'Lach.—Was taken sparingly at Loch Bhradain and Loch-an-Eilan.

TINODES

WÆNERI, L.—Very common everywhere.

LYPE

PHÆOPA, Steph.—Both sexes were taken at Loch Morlich.

PSYCHOMYIA

PUSILLA, F.—Occurred sparingly at Insh and Loch-an-Eilan.

RHYACOPHILIDÆ.

RHYACOPHILA

DORSALIS, Curt.—Very common everywhere.

GLOSSOSOMA

BOLTONI, Curt.—Exceedingly abundant all over the district, but chiefly so at Insh, Aviemore, and Glen Feshie.

VERNALE, Pict.—Not uncommon at Insh, Loch Morlich, Kingussie, and Loch-an-Eilan.

AGAPETUS

FUSCIPES, Curt.—Very common at Insh, Loch Morlich, Loch-an-Eilan, and Loch Bhradain.

COMATUS, Pict.—Not uncommon at Insh, Loch-an-Eilan, and Glen Feshie.

HYDROPTILIDÆ.

AGRAYLEA

MULTIPUNCTATA, Curt.—This species was apparently very local. At one little spot on the side of Loch-an-t-Seilich it might be taken in any number by sweeping.

HYDROPTILA

FEMORALIS, Eaton.
var. *longispina*, M'Lach. } —More or less common at Loch Inch and at Giack.

FORCIPATA, Eaton.—Abundant at Loch Insh, Loch Morlich, Glen Feshie, Giack, &c.

OXYETHIRA

COSTALIS, Curt.—Occurred in swarms at Loch Insh, Loch Morlich, Loch-an-Eilan, Giack, &c. An *Oxyethira* taken along with *O. costalis* differed in the form of the anal appendages, but at present it may perhaps be as well to look upon it as merely a variety of that species.

XXXVI.

ON SOME FORMS OF SPHAGNA FOUND IN THE GLENKENS, KIRKCUDBRIGHTSHIRE.

BY JAMES M'ANDREW.

[Read 23rd February, 1886.]

THREE years ago Mr. William Curnow, of Penzance, strongly advised me to gather and study the *Sphagna* of my own immediate district, assuring me that my labours would be amply repaid, and remarking that in his own experience it was surprising how many species, varieties, and forms of this genus may be gathered over a very limited area, and in places at first sight apparently unpropitious. With the bribe of having all doubtful specimens determined, as far as Mr. Curnow knew the *Sphagna*, I set to work, with the pleasing result that I have collected in this district all the British species of *Sphagna* given in *The London Catalogue of British Mosses* (1881), except *Sphagnum Lindbergii*, of which I have not yet despaired; and all the varieties, except var. *gracile* of *S. acutifolium* and var. *squarrosulum* of *S. strictum* (both of which are as yet considered doubtful British plants); vars. *imbricatum* and *laxum* of *S. squarrosum*; var. *pulchrum* of *S. intermedium*; var. *platyphyllum* of *S. laricinum*; and var. *longifolium* of *S. tenellum*,—in all, one species, and seven (or rather, five) varieties not yet found. I am aware that Dr. Braithwaite, followed by Mr. Hobkirk in his *Synopsis of the British Mosses* (2nd edition, 1884), has included other varieties recorded from Great Britain. These I do not yet know.

This shows that until any district has been thoroughly searched, no one can tell what may be gathered in it; but time, patience, methodical

working, and a residence in the district, are required to attain complete results.

All my specimens have been gathered within a radius of ten or twelve miles,—from Carsphairn in the north to Barend Moss in the south. The district of the Glenkens, with New Galloway as its centre, is peculiarly favourable for the growth and development of the *Sphagna*. It has great diversity of surface, much broken ground, wet sloping hill-sides, extensive moors, peat-mosses, and flows—as those of Moss Raploch and Barend Moss—almost entirely composed of *Sphagna*, marshy and swampy ground, and a very moist climate. Such large "flows" as the two mentioned contain any quantity of such mosses as *S. Austini*, and its var. *imbricatum*, in huge tussocks; *S. acutifolium* var. *elegans* mixed with the former, and var. *fuscum* in dense snuffy-brown cushions; and *S. cymbifolium* var. *purpurascens* or *congestum*, with its beautifully mixed tints, creeping into some shallow pool of water. The wet slopes of the granite hill called the Black Craig, alias Cairnsmoor of Dee, has plenty of *S. tenellum* in fruit; the east slopes of Cairn Edward, also of granite, contain *S. rigidum* in quantity, with its two vars. *compactum* and *squarrosulum*, the latter frequent in fruit; *S. molle* (of which Dr. Braithwaite says the typical plant is not yet British, and which Mr. Boswell regards as almost identical with its var. *Mulleri*) vars. *Mulleri* and *tenerum*, on the slopes; *S. laricinum* I have as yet found only in one spot; and other species and varieties in more or less frequency. Considering the great similarity in appearance of several species and varieties, it is not surprising that one may very readily pass them by unnoticed.

The following remarks are based upon what Dr. Braithwaite says in his work on *The Sphagnaceæ or Peat Mosses of Europe and America.*

To the uninitiated eye the various aspects and colours of these mosses must prove attractive, and

even to the utilitarian they are far from being despicable. The cryptogamic botanist finds in their tissues exquisite beauty; but, at the same time, great perplexity and difficulty in the determination of their variable forms, and this notwithstanding their clearly defined structure. It would be very difficult to state the causes of the variability in the species of *Sphagna*. The nature of the soil does not seem to have any influence on them, because the granite and greywacke of this district—rocks otherwise unproductive in mosses—bear *Sphagna* in quantity and variety. Moisture and drought, however, must sensibly affect the size, growth, and density of these water-loving mosses. Their beautiful tints of colouring must be the result of vital action, because the various tints they assume are dependent on the colours of the chlorophyllose cells of the leaves. We find the prevailing tints to be red, rosy-red, purple, shades of white, and various shades of green—some varieties receiving their name from their prevailing tint. Perhaps all these mosses have a tendency to vary either into a compact or a squarrose form, of which the two varieties of *S. rigidum—compactum* and *squarrosulum*—afford a very good example. The protean species *S. acutifolium* has the greatest number of varieties and forms, and many of these run so imperceptibly into each other that it is almost impossible to determine the exact variety. The only satisfactory method of determination is by a microscopic study of their tissues, because so many species very closely resemble each other in outward form. Nature has no fixed limits in *her* classification.

XXXVII.

NATURAL HISTORY NOTES FROM TARBERT.

BY THOMAS SCOTT.

[Read 23rd February, 1886.]

Lochfyne has long been famous as a hunting-ground for the marine zoologist; and the names of many eminent naturalists are associated with the records of its fauna, some of whom—as M'Andrew, Forbes, and Jeffreys—though passed away from the scene of their labours in the cause of Science, have left behind them a never-dying memory. Their love and zeal for natural history will continue to stir the heart of the student of nature who is fortunate enough to realise the importance of the work they have accomplished.

That Lochfyne contains within its profound depths, as well as in its shallower waters, many rare, interesting, and beautiful creatures, wonderful in their colouring, form, and sculpture, does not require to be proved by anything I may say; I wish simply to show that this treasure-house has been packed so full that though searched by many careful, keen-sighted devotees to science, there are yet nooks and corners in which enough has still been left to please the eye and delight the heart of the searcher. It will be a long time ere all that is contained in the roomy and well-filled storehouse of nature shall have been fully known. Well might the sweet singer of Israel say: "O Lord, how manifold are Thy works! in wisdom hast Thou made them all: the earth is full of Thy riches. So is this great and wide sea, wherein are things creeping innumerable, both small and great beasts."

The following notes relate to some species of marine organisms recently observed in the course of a series of dredgings in East Loch Tarbert and neighbouring parts of Lochfyne. In these notes I will not go very deeply into scientific discussion, but will briefly describe any apparently peculiar or interesting features in the form, colour, or habit of each species mentioned.

CRUSTACEA.

CHERAPHILUS (CRANGON) NEGLECTUS, G. O. Sars.—I first noticed this species in November last, among some other things dredged in East Loch Tarbert. Since then I have also obtained it in Lochfyne, both to the north and south of Tarbert, in from about 3 to 10 fathoms. It comes very near to *C. fasciatus*, Risso; but the rostrum, instead of being truncate as in that species, is rounded. There are, besides, some other points of difference. The Rev. Canon Norman, F.L.S., says in reference to this species: "This is the first time that *C. neglectus* has been recognised in our fauna, though probably Clyde specimens which have been called *C. fasciatus* belong to it."

VIRBIUS (HIPPOLYTE) FASCIGER, P. H. Gosse.—This is a very pretty species, and of frequent occurrence. It is subject to considerable variation in the arrangement of the colours, but is generally adorned with a few brownish or reddish transverse bands. In the more constant form a narrow dorsal line of a dark brown colour extends from the head to the tail; and a narrow ventral line of the same colour meets the dorsal line at these extremities. These lines follow the curvature of the body, widening considerably near the middle; and the intervening spaces are clear and almost transparent, so that at a short distance one can scarcely get rid of the idea that it is a skeleton and not a living creature he is looking at. A marked peculiarity is the

presence of a number of plumose tufts on the abdominal segments; but these tufts are easily rubbed off in moving the creature about, if one is not very careful.

Erythrops pygmæa, G. O. Sars.—This little schizopod is rather scarce. I have got one or two specimens near Barmore, Lochfyne (a little north of Tarbert), and the tail half of another among some material dredged in East Loch Tarbert. Canon Norman states that this species is new to Britain. I do not know whether the genus is already represented in our fauna.

This little creature, about $\frac{3}{10}$ of an inch long, is really beautiful when alive, having the lovely bright red eyes characteristic of the genus.

Siriella armata, M. Edwards.—I have as yet got only one specimen of this species, which was dredged in a small bay a little north of the entrance to East Loch Tarbert. It is armed with a long pointed rostrum. Canon Norman regards it as probably identical with *Mysis Griffithsiæ*, Bell, so named in honour of Mrs. Griffiths, "a lady," Professor Bell says, "to whom natural history is greatly indebted," and from whom he received the only specimens of the species then known. Mrs. Griffiths obtained them at Torquay.

Siriella Brooki, Norman.—This also is a somewhat rare form. Canon Norman considers it to be new, and has provisionally named it after Mr. G. Brook, F.L.S., Naturalist to the Fishery Board for Scotland. I obtained this species in October last year when dredging among *Zostera* in shallow water in East Loch Tarbert. It was readily distinguished from the numerous forms of the commoner *Mysidæ*, with which it was associated, by its leisurely mode of swimming. It did not jump aside at every little obstruction, as they did, but turned deliberately away in another direction.

PHRYXUS PAGURI, Rathke.—"This species was first found by Rathke on the Norwegian shore"; * and White remarks that "it is most probably also a native of our seas." † Mr. White, when writing this, does not seem to have been aware that the species had been noticed in August, 1848 (nearly nine years before), by Mr. Robert Templeton, "on a *Pagurus* dredged off Bird Island, Strangford Lough." ‡ It has been obtained at Polperro by Mr. Couch, and at St. Andrews by Professor M'Intosh. I have obtained one male and two female specimens; one of the latter was got in East Loch Tarbert, the other near Battle Island, Lochfyne (a little south of Tarbert)—in both cases attached to *Pagurus Bernhardus*. I got the male along with the female on the same specimen of *Pagurus*.

CRYPTOTHIRIA BALANI, Spence Bate. — This curious parasite, a specimen of which I found on *Balanus balanoides* on the 27th of last month, was first noticed by Mr. Henry Goodsir, and described by him, in the *Edinburgh New Philosophical Journal* for 1843, as the male *Balanus*; but its true character as a parasite was not discovered till 1851, when Mr. Spence Bate was led to investigate its history. I cannot find any localities mentioned for this species; but in the *British Sessile-eyed Crustacea* it is stated that the female has been frequently taken by the authors of that work, and always on the species of *Balanus* mentioned above. The female (which I found my specimen to be) is well described as "a large, inert, seven-lobed mass, destitute of exserted antennæ, jaws, legs, or branchial appendages." §

JANIRA (ONISCODA) MACULOSA, Leach.—I have seen a few specimens of this isopod in East Loch Tarbert, when turning over stones at low water during the

* Bate and Westwood, *British Sessile-eyed Crustacea*, ii. 242.
† White, *Popular History of British Crustacea*, p. 257.
‡ Bate and Westwood, *l.c.*, ii. 240.
§ *Id.*, ii. 267.

spring tides; but it appears to be scarce, though possibly it may be of general occurrence around our shores. It is readily distinguished by the long external antennæ and caudal appendages. I have not met with it far above low water; and its colour mimics so well the stones which it frequents, that if the creature had the sense to remain perfectly still, sharp eyes would be required to see it. Its scarceness may therefore be more apparent than real.

This species was exhibited to the Society on 26th March, 1861, by Mr. David Robertson, F.L.S., F.G.S., from the Cumbraes, "being an addition to the list of Crustacea found in that locality";* but no Scotch locality is given in the second volume of Bate and Westwood's *British Sessile-eyed Crustacea*, although that work was not published till seven years after. No locality is given in White's *Popular History of British Crustacea*.

PHILOUGHRIA ROSEA, Koch. — I obtained this isopod a few days ago at Tarbert, near the Marine Laboratory of the Fishery Board for Scotland. On turning over a piece of wood that was lying about 20 yards above high-water mark, I noticed beneath it a "slater" with which I was unfamiliar. On examination it proved to be the species mentioned above.

Its colour was white, with a dark brownish-black band down the middle of the back, on each side of which was a band of a fine red colour. None of the bands were very broad, nor had a very decided outline; they all showed rather a tendency to shade off into each other. The only apparent discrepancy was in the colour of the eyes, which are said to be black in *P. rosea*, whereas those of my specimen were red.

According to Bate and Westwood's description, this species would appear to be very restricted in its distribution in Britain, the only record of its

* *Proceedings, Nat. Hist. Soc. Glasg.*, i. 12.

occurrence being as follows: "We believe that this species has only hitherto been found in Mr. C. Spence Bate's courtyard and cellar, and that of neighbouring houses at Plymouth, where it is tolerably abundant."*

IDOTEA PELAGICA, Leach.—I have frequently seen this species at Tarbert; but, until a few days ago, I had not examined it, thinking it to be the young of *I. tricuspidata*, which is common enough. Having detected some females with ova, however, I was led to examine the animal more closely, with the result that it proved to be *I. pelagica*. The lower antennæ are shorter and stouter than those of *I. tricuspidata*, the flagellum is hairy, and it wants the tricusped form of the tail of that species.

It is said to be "common on the Bell Rock—probably common all round the coast in the laminarian zone."† I have frequently found it above low-water mark about empty barnacle-shells.

ANCEUS sp.—Canon Norman says he does not recognise this as among the described species of the genus. The only specimen which has yet been obtained was dredged by me in East Loch Tarbert early in December last. The following is a description of it.

Length about ·14 of an inch. Cephalon nearly twice as broad as long, considerably depressed in front, the depression extending backwards and upwards so as to form a concave slope; eyes lateral and close to anterior edge of cephalon. Mandibles large, blunt pointed, length from anterior edge of cephalon about $\frac{1}{8}$ of the whole, broad near proximal end; inner edge of each nearly straight, abruptly narrowed near base by a rectangular constriction to about half the width of the portion immediately above; outer edge concave, curving

* Bate and Westwood, *l.c.*, ii. 241.
† *Id.*, ii. 385.

downward and outward from the blunt-pointed apex for about $\frac{3}{4}$ of the length, the remaining part being nearly parallel with the narrowed base of the inner edge. Second and third segments of pereion very short, subequal; fourth rather longer and narrower; fifth about the same length as the first, rather narrower than last; sixth rather longer than fourth, depressed backwards and extended laterally so that the posterior edge is somewhat hollow. Pleon, excluding tail appendages, about $\frac{1}{5}$ of the whole length ($\frac{1}{4}$ of whole length if tail appendages be included), dorsally depressed; segments nearly equal in length and breadth, but rather narrow posteriorly, and about half as broad as pereion. Telson somewhat triangular (but not so much as that of *A. maxillaris*), slightly longer than lateral appendages.

In other respects this specimen somewhat resembles *A. maxillaris*; and but for the very marked difference in the shape of the mandibles, it might be considered a form of that species. Should it prove to be new, I would propose *Normani* as its specific name, as a recognition of kind assistance given at various times by the Rev. Canon A. M. Norman, F.L.S., &c.

Tanais vittatus, Rathke.—One striking feature in this species is the dense fascicles of hair which clothe the second and third segments of the pleon. It is of frequent occurrence here among the clusters of *Balani* that cover the rocks above low-water mark. From what I have observed of its habits, I am inclined to believe that it preys on the *Balani*. In a paper entitled *Dredging Notes from the Bay of Rothesay*, read before this Society on 31st May, 1870, this species is said to be frequently found in the tufts of *Cladophora rupestris*."* It is stated that "when disturbed they escape and will spring to a considerable distance. This is

* *Proceedings, Nat. Hist. Soc. Glasg.*, ii. 50.

probably done by bringing the head and tail together."* This I have not seen them do, even although I assisted them to get their "head and tail together." They certainly try to escape, but it is a slow process.

PORCELLIDIUM FIMBRIATUM, Claus.—This little copepode, which seems to be generally distributed, is common here—not only among material dredged at a depth of from five to ten fathoms, but also upon fronds of *Laminaria* at low-water mark. Specimens of this species were exhibited to the Society by Mr. Robertson in 1864. A peculiar habit of this little creature, which I have not seen noticed elsewhere, is that if disturbed when running about on a frond of *Laminaria* it will adhere so very firmly, limpet-fashion, that it can only be detached with some difficulty. A very good plan is to allow it to run, guiding its movements towards the edge of the frond, when a sudden jerk removes it ere it has had time to turn the corner.

PELTIDIUM DEPRESSUM, Baird (*P. purpureum*, White).—This is a beautiful species of copepode, of which there is a very good figure in White's *Popular History of British Crustacea*. In the second volume of Dr. G. S. Brady's *Monograph of British Copepoda* (published in 1880) there is no record of its occurrence in the West of Scotland; but Dr. Brady states that it "will probably be found wherever *Laminaria saccharina* grows." He also says: "It does not often occur amongst dredged material, but I noticed it on one occasion amongst coarse sand from a depth of four fathoms at Sunderland." It is *only* amongst dredged material that I have hitherto found it, and have sometimes obtained a good number of specimens in one dredging. Its colour is yellowish, with the second and third segments of a fine deep purple.

* Bate and Westwood, *l.c.*, ii. 128.

There is another pretty species (*P. interruptum*, Goodsir) which is much more common. Its colour is a uniform reddish brown, and its movements are lively.

LAOPHONTE HORRIDA, Norman.—Dr. Brady speaks of this species as "remarkable and strongly characterised," and states that it "has been noticed in Britain as yet only on the Atlantic coasts of Scotland and North of Ireland." Certainly it has a very "touch-me-gin-ye-daur" look about it, which Mr. Norman sems to have recognised when he gave it its name. I have seen a number of specimens, but only in material from East Loch Tarbert dredged in about 5 or 6 fathoms. Dr. Brady further says: "My collection contains several specimens which were dredged off the Island of Cumbrae amongst vegetable and other *debris*, and one from a depth of fifteen fathoms off Portincross (Ayrshire). Mr. Norman found a single example in material from Oban, and lastly I have noticed it in material washed from the roots and fronds of *Laminariæ* in Mulroy Lough, Donegal. Female specimens only have been observed."* I have got both male and female forms.

MOLLUSCA.

The following three molluscs may be worthy of notice:

LAMELLARIA PERSPICUA, Linn. — This species is of frequent occurrence on the under side of loose stones on the north side of East Loch Tarbert, at and a little above low-water mark. It is one of those molluscs of which one hardly knows what to make when seen for the first time. It certainly does not at first seem to be allied to *Velutina*, and yet it belongs to the same family. In referring to *Lamellaria*, Dr. Jeffreys says: "This resembles a *Doris* (one of the sea-slugs) in appearance; and no one who is unacquainted with the varied structure

* Brady, *British Copepoda*, ii. 75.

of the Mollusca would suspect that the soft body of the *Lamellaria* had an internal spiral shell to protect its vital organs." * It has been recorded from Cumbrae.

PLEUROBRANCHUS PLUMULA, Montagu.—I have as yet got only one specimen of this species under a stone at extreme low water on the north shore of East Loch Tarbert, nearly opposite the "Columba" Wharf. It was of a fine lemon yellow colour, and nearly two inches long. At a meeting of the Society on 26th April, 1870, Mr. Robertson remarked, in reference to the occurrence of this species at Cumbrae, that "during that month he had procured three or four specimens from the fishermen of Cumbrae, who had found them adhering to their lines, brought up from deep water. Previously he had looked upon the species as rare in that locality, having only obtained two specimens in all his experience there." † Dr. Jeffreys describes it as "local and not common."

XYLOPHAGA DORSALIS, Turton.—I occasionally get this curious and destructive mollusc in East Loch Tarbert. From a small piece of wood brought up by the dredge, and measuring about seven inches in length and one in diameter, I took fully 250 living specimens, large and small. Another small piece of wood with dead shells was brought up by the dredge in Lochfyne. This species has been recorded from Lochfyne by M'Andrew, and from the Docks, Ardrossan, Ayrshire, by Martin.

In conclusion, I wish to record my indebtedness to the Rev. Canon Alfred M. Norman, F.L.S., &c., for his kind assistance in identifying certain species, and for valuable information connected therewith; and to Mr. Richard M'Kay for supplying me with notes from the first and second volumes of the Society's *Proceedings*, bearing on some of the lower forms of crustacea mentioned in this paper.

* Jeffreys, *British Conchology*, iv. 234.

† *Proceedings, Nat. Hist. Soc. Glasg.*, ii. 32.

XXXVIII.

ORNITHOLOGICAL NOTES.

BY W. CRAIBE ANGUS.

With two Plates [IV. and V.].

THE SHORE-LARK.

Alauda alpestris.

[Read 23rd February, 1886.]

By the kindness of Mr. Robert R. Sutter, East Barnes, Dunbar, I am privileged in showing an example of the Shore-Lark which was shot by him near Thornton Loch on the 30th of January last. When first observed by Mr. Sutter, the bird, with five others, was on the sea-beach feeding in company with a small flock of Sky-Larks. On being disturbed the flocks separated, each species keeping by itself. The strange note and heavy flight of the Shore-Larks, contrasting with the familiar note and movements of the indigenous birds, arrested the attention of Mr. Sutter. He accordingly followed them to a field of barley-stubble about 150 yards distant, and separated from the sea-beach by a strip of natural grass not more than 30 yards in breadth, where they had alighted and were feeding.

The bird is a male in winter plumage. It is badly shot about the legs; and, as stuffed, the crescent-shaped black patch on the breast is somewhat larger than when the bird was in the flesh.

The first occurrence of this species in Britain was at Sherringham, in Norfolk, in 1830; and ten years later it was obtained in Scotland. Since then it has been found in such increasing numbers as to lead to the supposition that from its similarity to allied species, more especially when in winter plumage, it may formerly have been overlooked.

THE CAPERCAILLIE.

Tetrao urogallus.

[Read 30th March, 1886.]

As an indigenous species, this lordly bird of the forest had disappeared from the British fauna before the close of the last century. Records show that about 1745 it had become very rare, if not actually extinct, in the districts of Scotland that had previously afforded it shelter; and it is doubtful if at that date a single pack of any importance lingered in any of its ancient strongholds. Inverness is generally supposed to have been the death-place in Scotland of the species; but from information I received in 1872, on the publication of some notes in the *Aberdeen Free Press*, I am inclined to think that the species vanished among the pine-trees of Ballochbuie, which in the early part of the present century were regarded as the strongest survival of the ancient Caledonian forest. I learned that the late Mr. James Giles, R.S.A., who was an excellent observer and greatly interested in natural history, had prepared an account of the occurrence of the species on Deeside. This was based mainly on oral information supplied by Sir Robert Gordon, of Old Balmoral, an intimate friend who took a keen interest in all matters relating to sport, and by his gamekeepers. Mr. Giles' notes were made at the request of Dr. Macgillivray, for publication in the *Natural History of Deeside*; but they did not appear in that work, not having been incorporated in the manuscript before the death of the author. From the back of a study of black-game in water-colours, painted at Balmoral in 1830, I copied the following which is in the handwriting of the artist: "Two Coileach-collie, Capercailzie, were shot in Ballochbuie, on the occasion of a marriage rejoicing, in 1785, and which Sir Robert is confident were the last of the native birds heard of in Scotland. Pennant saw the bird at Inverness in 1772."

During a ramble in Upper Deeside in 1870, I found the memory of the ancient race still lingering in Braemar, where I was introduced to a woman, who had turned her eightieth year, whose grandfather had been gamekeeper to the Earl of Fife. We had a very interesting chat about birds; and if I had understood Gaelic, I should have learned more than her interpreter could clearly render into English for me. Her grandfather, she said, was looked upon as "wise" on the subject of birds, and he never wearied of speaking about them. His name for the Dotterel was "Cairn-trottle"—a name as beautiful as it is expressive of the habits of the bird, which in the breeding-season is found only on the stony portions of the higher mountains. "Coileach-collie" (or "horse of the woods") was his name for the species under notice, which even in his day was considered a great "ferlie." One of her grandfather's favourite stories related to the capture of a Capercaillie by a fox. He described the bird as "the tamest and shyest brute in a' the wuds: so shy that he would hardly alloo o' a flint (*i.e.*, flint lock-gun) being struck at him; and so tame that he saw him in Glen Lui staunin' flappin' his wings i' th' sun as if a' fear had left him, and he never kent he was in danger till foxy grabbit him." This description is consistent with the well-known habits of the Capercaillie in spring, and cannot apply to any other species.

The Capercaillie is polygamous; and hybrids with allied species are therefore of frequent occurrence, even in countries where the species has long been resident. In a country like our own, where the bird has been recently introduced and is rapidly spreading into districts inhabited by Blackcock, hybridism almost invariably shows itself with the establishment of the species. For this there are two reasons: (first) that when migrating the sexes generally separate, the females moving in advance

of the males—a habit not confined to this species; and (second) that strange birds—such as the male Blackcock and female Capercaillie, and *vice versa*—are more likely to cohabit on their first meeting than on their better acquaintance. I have it on the authority of a well-informed gamekeeper that on the first appearance of the Capercaillie the Grey-hen generally forsakes her mate, and encounters between the males are not unfrequent.

The hybrids vary considerably in size and plumage; and the plumage, in its progress from the immature to the adult state, undergoes the transition common to both species. The larger birds resemble the male Capercaillie; and in both instances the configuration and general colouring of the birds follow those of the male parent, the resemblance being greatest when the birds are adorned with the perfect plumage. A marked difference, which is apt to lead to confusion, exists in the form of the tails, the larger bird having the rounded tail characteristic of the male Capercaillie, and the smaller bird the forked tail of the Blackcock.

We are indebted to Messrs. M'Culloch & Sons, Sauchiehall Street, for the loan of the smaller bird, which was recently shot on the banks of Loch Lomond; and to Mr. Henry Martin, West George Street, for the larger bird, which was trapped a few days ago in the Black Mount.

The accompanying plates (IV. and V.), which give a very faithful representation of both the hybrid birds as stuffed, have been executed by Mr. Duncan Mackinlay, C.M., one of the members of the Society.

THE PINTAIL DUCK.

Dafila acuta.

[Read 23rd February, 1886.]

This bird, which I am enabled to show in the flesh, has been kindly forwarded by Mr. George

Pow, Dunbar, for exhibition at our meeting to-night. It was received by Mr. Pow from a labourer who shot it on the Tyne estuary during an easterly storm on the 17th of February last. The bird was shown to the shore shooters, to whom it was unknown, none of them having a name for it. It is fortunate that this fine example of one of our most beautiful as well as rarest birds should have fallen into the hands of a gentleman capable of identifying it. Mr. Pow, who has had the opportunity of examining all the rare birds shot by the local gunners during the last eight years, is certain that the bird under notice is the only example of the species that has been procured during those years in the vicinity of Dunbar—a district which may be said to be prolific in the rarer water-birds.

The specimen weighs two pounds, being 12 ounces heavier than another male of this species which I formerly had an opportunity of weighing. It measures 27 inches in length from point of bill to tip of tail, the tail being cuneiform and graduated, the two central feathers extending $2\frac{3}{4}$ inches beyond those nearest to them. The wings measure $10\frac{3}{4}$ inches from the carpal joint, and the mandibles $2\frac{3}{4}$ inches to the gape. The claws are very sharp. So sharp have I found them in six examples (four of which were adults), examined when recently killed, that I conclude that the species feeds but seldom from choice, if at all, on land.*

* Keeping in view the excellent paper by Mr. David Robertson, jun., in the *Proceedings* of the Society, vol. iii., p. 332, I was anxious that the shells which were found in the stomach of the bird should be authoritatively identified. I accordingly handed them to Mr. A. Somerville, B.Sc., F.L.S., who, having himself failed to identify them, forwarded them to Mr. J. T. Marshall, Torquay, the eminent conchologist. Mr. Marshall has replied as follows: "I am sorry to have to return your shell fragments undetermined, but it is quite impossible to identify a single fragment with any known species. They have been picked up on a pebbly beach, and are rolled, worn, and bleached beyond recognition."

The male Pintail in perfect adult plumage, as is the example under notice, I reckon to be one of the most elegant of our birds. The body inclines more to length and less to plumpness than is usual with its congeners; and it is certainly the most rapid on the wing, and in all its actions the most deft and sprightly, of the *Anas* tribe that has come under my observation. It is remarkable, too, for the delicate softness of its plumage, the refinement of which corresponds with the gaiety and gracefulness of its habits.

In May, 1884, I shot two which have been recorded in *The Birds of the West of Scotland*; and on another occasion I had a leisurely opportunity of observing, with the aid of a binocular glass, the amours of a pair which I hope had a happier fate. The birds were feeding in a lakelet, which has now, as the world goes, been civilised out of existence. The male was in a frolicsome mood; and no Robin-redbreast—beyond all others the gentleman of the land-birds — no Phalarope or Bittern, which vie with each other for the gentlemanship of the wading-birds — was ever more sprightly or accomplished than this gentleman of diving-birds, who serenaded his mate while he gamboled in the water as if for the fun of the thing. Now silent, with tail erect—now garrulous, with his beak stuck quaintly in the feathers of his neck, and his body raised out of the water, as if standing on the point of his long tail—now uttering a mellow sound inhaled from the air rather than emitted from his throat—now mewing like a kitten before it has seen the light, and jerking his head in the manner of a man with a "habit"—he gaily disported himself, conscious of no other auditor than his proud but passive mate.

THE GREAT CRESTED GREBE.

Podiceps cristatus.

[Read 30th March, 1886.]

One living in our latitude seldom has the satisfaction of handling in the flesh so beautiful an example as that which I am now privileged to lay before you, of the Great Crested Grebe, one of the rarest of our British birds, and, with the exception of the Eared Grebe, the rarest of its tribe.* The bird was shot at Kilmun in the last week in February, and was sent to Mr. H. Martin, Taxidermist, for preservation. Before removing the skin, Mr. Martin kindly allowed me to examine the plumage; and he afterwards gave me the body of the bird, which on dissection proved to be a female. The ovary was full of eggs, those most developed being about the size of swan shot.

The bird had all but passed through the moult and completed the perfect summer dress. The eye had attained the lustrous spring hue, corresponding to the rich brownish red on the side of the head which fades as the summer advances; and the breast had that lovely silvery sheen so much coveted for purposes of dress by ladies of taste. The head and neck are in the moult, the wing coverts and secondary wing feathers changing from dusky black to white. The legs and feet are dark, mottled with yellow, the white and yellow taking the place of the darker colours.

The bird weighed 1 lb. 5 oz., and measured as follows: From point of bill to claws of the extended legs, 25 inches; from the same point to the tarsal joint where the feathers terminate, 21 inches.

* The Grebes, even more than the Gulls and Swallows, are popularly known by their generic names only, "big dabchick" and "little dabchick" being almost the sole specific names by which the members of this family are distinguished by the gunner of the coast and common who reckons them to be his most "kittle" shot.

The contents of the stomach, the greater portion of which I have mounted for convenient examination by you, are very interesting. In addition to the usual feathers, preened from the body of the bird itself, the stomach contained a quantity of greenish vegetable matter, which still tinges the feathers in spite of much soaking in water. It also contained what I consider to be a very unusual object for a Grebe to have swallowed,—a strip or shaving of resinous wood cut by a joiner's plane. This shaving of pine wood, which the bleaching has not restored to its normal colour, was coiled in circles taking the form of the interior of the stomach. It was lined on the outer rim with a coating of feathers closely matted or felted together, and the coils enclosed a ball of feathers which had probably been previously in the stomach. The shaving measures rather over 6 inches in length, and is folded longitudinally throughout in three parts of about equal breadth. Its greatest width is about 3½ inches. The wood along the edges of the folds is considerably worn by the action of the stomach, and as now extended to its full length it shows these worn parts in apertures of various dimensions. The shaving had probably become pliable by contact with water before the bird swallowed it.

The webs on one of the feet have evidently been wounded, and a rudimentary or additional membrane of considerable size has been developed in the process of healing.

The Grebe is of an extremely shy and retiring disposition, making its nest in the lone and sedgy nooks of our inland lochs; and although the habits of few of our birds are more remarkable than those of the Grebe, its movements cannot in any sense of the term be called picturesque, nor are its actions performed by choice in the presence of man whom it seems to shun. It is but a poor walker, its legs, which have to perform the double duty of tail and legs, being inserted almost at the extreme end of

its body. This renders walking an awkward feat, and almost impossible except for a very short distance. Its flight may be described as a sort of compromise between that of the Duck and the Magpie; and its attempts at walking resemble the ill-timed movements of an excited puppet, in which it is difficult to say whether the feet or the wings are exercised most. Like the Corncrake it is difficult to flush, except on its first arrival at its summer quarters. When flushed it will take a circular flight, rising high in the air and returning to the spot from whence it was driven, immediately to disappear beneath the surface of the water. Its peregrinations on foot are mostly limited to the boggy flats on the margins of the water into which it can almost instantaneously withdraw itself, and accordingly its actions can hardly be studied without the aid of a telescope. The wanton gracefulness of the Grebe is seen to best advantage in what appears to be its true element—the water. While swimming it carries its head close to the surface, like a rat, and its aptness in diving is truly marvellous. Notwithstanding these peculiarities, our poets have either overlooked or set aside the Grebe as a subject unsuited to the muse. So far as I can recollect at the moment, Pope is the only poet of note who has adverted to this bird; and his description of its comportment is so graphically expressed in a couplet, that I cannot here refrain from quoting the lines:

> "As when a dabchick waddles through the copse
> On feet and wings, and wades, and hops." *

The birds, when plentiful, are gregarious; and

* If the poets have not vilified or traduced the Grebe, as they have some species, they have all but ignored it. This fact is all the more remarkable when we take into account the extent to which the skin of the bird (including what passes current as such) is used in making those cuffs and collars for ladies, which, be the fashion what it may, are always in vogue.

their nests are irregularly grouped by the margins of lakes, and placed behind a fringe of tall herbage. While they are thus screened from the pedestrians on the banks, they are generally left exposed to the boatmen on the water, from whom the birds conceal themselves by diving, and hide their eggs by overlaying them with reeds and such herbage as the locality may afford. The nest itself is little more than a puddle in which the eggs are laid and hatched. It is formed of huge masses of reeds or kindred plants, often cropped in the green state and laid almost anyhow athwart each other.

The number of nests is generally greatly in excess of the pairs of breeding birds. This habit of building more nests than the female requires for immediate use, seems among our own birds to be confined to the Wren and the Grebe. These additional or "he-nests" (so called from the circumstance that the male Grebes use them, while the females are sitting, as a vantage-ground from which to descry the approach of the enemy) often afford the only available firm footing in the immediate neighbourhood on which the birds may rest themselves. This, however, is not the only use of these surplus nests, if indeed it be their primary purpose. The allocation of one to each bird does not exhaust the number of nests usually provided; and it would be absurd to say that the male required more than one nest for a watch-tower, or that the nests were constructed through mere caprice. I regard them rather as multiple or reserve nests, provided, I have no doubt, in anticipation of the ever-recurring winds and floods to which they are exposed. The nest itself is but a floating mass of pithless herbage with its wonted rigidity soaked out; and it is continually liable to be deranged, and not unfrequently wrecked by the agitation of the water during storms. The wary, wily, and agile Grebe, in view of such contingencies, wisely provides a reserve in these multiple nests to which it may transfer its eggs in

case of accident to the original nest. From a nest which had drifted to the open water of Loch Skene from its place among the reeds, I have seen the bird remove the eggs, four in number, to a reserve nest whose moorings had not been loosened by the storm. The eggs were in all probability carried below the wing of the female bird as it swam from nest to nest, the male remaining on the reserve nest from the moment the first egg was transferred to it. On another occasion I saw a nest, on which the female was sitting, drift from one side of Loch of Park, in Aberdeenshire, to the other, in such favourable circumstances that the act of incubation was not interrupted. The female continued sitting while the nest floated across the water; and although our boat was rowed within a yard of her new position, she still remained on the nest. On the following day the young birds were afloat.

I have it on the authority of Mr. David Wilkie, a patient observer of nature, that on the same loch a nest with six highly incubated eggs was completely wrecked during a storm, the eggs disappearing in the water. The birds, with commendable affection (and no less commendable courage, for a boating party were fishing close by), recovered the eggs by diving, their journeys to the bottom being frequently unrewarded. The eggs as regained were placed upon a reserve nest, and four of them were hatched on the fourth or fifth day thereafter. As no addled eggs were discovered in the nest on a search after the young birds had been hatched, it is probable that two of the eggs had not been recovered.

Another fact, regarding the removal of a brood of young dabchicks by the parent birds from disturbed to more peaceful quarters, is here worthy of record. The dabchicks were hatched in a large pool in the Moss of Park; and having been disturbed by the frequent incursions of a batch of young dogs which Mr. Wilkie was then breaking, and by the diminished size of the pool after a protracted drought, the female

carried the chicks one by one to the Loch, the male accompanying her when she was removing the last bird.

THE SKUA.

Lestris catarractes.

[Read 28th April, 1886.]

I am inclined to think that on the East Coast of Scotland the Skua is an annual visitor, though occurring in very limited numbers and rarely coming near the shore. It is there known by the following names, with others even less poetic, viz.— "Gue-robber," "Thief-Gull," "Pirate-bird," "Dirten-Allan," "Bonxie," &c.

The Skua is fiercely rapacious, and of a very inquisitive disposition. In scouring the seas it keeps an eye on whatever objects, living or inert, may be floating on the water; and it cultivates a familiarity with the fishing-boats, which is always welcome to the fishermen who somehow associate the appearance of the bird with good-luck. Not unmindful of the compliment implied in its confidence, they throw it offal which it devours greedily and without fear.

So free is the Skua from all suspicion of harm on the part of the fishermen, that I have seen it, while an oar was passing over its head, hold on to garbage thrown to it from a boat; and at times the bird was so near to the boat that I had no difficulty in determining it to be a bird of the year. I could distinctly see the down, which adhered to the feathers on the crown of the head and extremities of the larger wing-feathers, quivering in the sunny breezes of the September morning. While showing every confidence in the boat, the Skua kept its eyes rivetted on a flock of enraged and envious Gulls that its presence had attracted, which kept soaring and screaming around us, till, having secured his repast, the object of their wrath made off. Following the humours of the Skua, the Gulls, joined by

the Terns, soared high in the air, or skimmed the surface of the water, the procession swelling in numbers as it passed southward.

On another occasion I saw an Osprey, which for the greater part of a week had frequented in early morning the mouth of the river Don, hunted up the stream as far as the new bridge by an adult Skua. The Skua was the undoubted master of the Osprey, whose frequent attempts to turn the course of his antagonist were entirely abortive. In its thrusts with the Osprey the flight of the Skua was grand and dignified beyond that of any British bird—the Golden Eagle alone excepted. Both fell victims to the gun, the subsequent fortunes of the dead Skua being by no means ignoble. Shortly afterwards Mr. J. C. Hook, R.A., wished to illustrate Bewick's description of the ferocity of the species when defending its nest from the attacks of robbers. Having failed to procure a specimen in London, he requested the late Mr. Macdonald, of Keppelston, with whom he was on intimate terms, to endeavour to obtain one for him. My own collection at the time being the only one in Aberdeen that contained an example of the Bonxie, I willingly gave the bird to Mr. Macdonald for presentation to the artist. The mounting of the specimen was personally superintended by Mr. Hook; and it served for the model of the bird in his picture, which was exhibited in the Royal Academy of 1873. The entry in the Catalogue of the Academy for that year is as follows:

254.—THE BONXIE, SHETLAND,.....*J. C. Hook*, R.A.

"They who are about to rob their nests, hold a knife or other sharp instrument over their heads, upon which the enraged bird precipitates and transfixes itself."—*Bewick.*

The picture is clever enough in the manner of the artist, and is redeemed from absolute failure by passages of sea which alternately darken and glow under the movement of the clouds. As is usual

in Hook's works, however, the sky is but a dead blank containing neither light nor true cloud-forms; and the picture is of no more value as a contribution to natural history than are those of the earlier academicians who painted eagles' nests containing beautifully-dressed babies. The artist, not having himself witnessed the incident, and having failed to interpret aright Bewick's description (which is anything but clear), represents the nest of the Bonxie as being in a precipitous rock facing the sea, whereas it should have been placed on the flat moorland.

The Skua is by far the most courageous of our swimming birds; and he seems to prefer a life of plunder to fishing on his own account, although an onlooker would suppose a life of honest industry to be more easily followed and less vexatious to the bird than that of a freebooter. His mode of plundering is to watch the Gulls and Terns while fishing, and to pounce upon any one of them he may have observed catching a fish. When thus attacked, the Gulls, and more particularly the Terns, scream aloud and try to escape without having to disgorge the coveted booty. Such encounters are sometimes highly exciting, as was one we witnessed in December, 1872. A Herring Gull, on being attacked, endeavoured to escape by rising in the air so as to get above his antagonist; but the pirate bird kept soaring uppermost, thus making the escape of the Gull impossible. The contest was a keen one. The Skua faced the Gull, evidently intent on bullying him out of his repast. By a vigorous effort that seemed to bring all his energy into full play, the Skua poised himself in a somewhat perpendicular position, his head, which was tremulous with excitement, pointing slightly forward and his fan-like tail pointing directly downward. Thus poised he screamed, and beat violently with his feet, like a Falcon. The Gull, after showing signs of exhaustion, sank below his antagonist, dropped the fish, and

with a sudden turn made off. The Skua, with dextrous rapidity, made a dart at the fish, which he seized before it had reached the water, and swallowed it as he skimmed the surface with that bold air which marks the master of the menial Gull.

XXXIX.

ON THE PAGODA STONE OF THE CHINESE.

(*Orthoceras*, sp.)

BY JOHN GRIEVE, M.A., M.D., F.R.S.E., F.L.S.

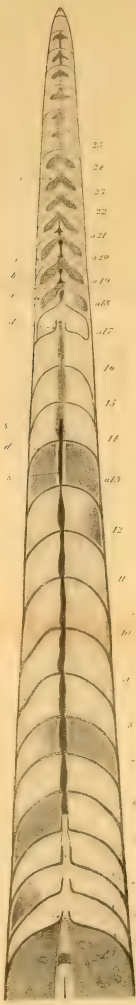
With one Plate. [VI.]

[Read 28th April, 1886.]

THIS species of *Orthoceras* was described by Dr. S. P. Woodward in the *Quarterly Journal of the Geological Society* for 1856,* from two specimens in the British Museum, which were obtained some 200 miles from Shanghai, and had been used as screens, having been mounted in carved frames on stands. They are labelled "Devonian?"

In a paragraph in the *Geologist* for 1860,† we read that Dr. Hochstetter, after referring to the value set upon groups of crystals and organic remains by the Chinese, remarks that "plates of dark brown limestone imbedding splendid specimens of Orthoceratites are, when polished and framed, highly esteemed as ornamental furniture for state apartments. They are said to be frequent at Yunnan," and he adds, "their Chinese name of Pagoda stone is derived from the general opinion that these Orthoceratites, showing indeed in their alveolus, and in the septa going through them, a certain similitude with the structure of these buildings, are formed underground in places on whose surface the towers of a pagoda project their shadows." I have examined all the volumes of the *Geologist*, and the *Journals of the Geological Society* for the last thirty years, the *Proceedings* of kindred societies, as well as the more recent travels in China within

* Vol. xii., p. 378. † p. 419.



THE PAGODA STONE (ORTHOCERAS SP.)

my reach, and have failed to find any further reference to these fossils. Nothing definite appears to have been known of the locality where they were obtained. They must also be extremely rare, as there appears to be no specimen in the Edinburgh Museum, and it was only the other day that a small one was presented to the University Museum here.

The two fine specimens which I have the pleasure of exhibiting were presented to my cousin, Mr. W. L. Buchanan, the larger by the Rev. George Cockburn, and the other by the Rev. Andrew Dowsley, Missionaries of the Church of Scotland, stationed at I'chang, in Central China.

I'chang, in the province of Hupeh, was opened as a treaty port after the murder of Mr. Margarey in 1875. It is situated on the left or north bank of the Yang-tse-kiang, about 1,000 miles, in round numbers, from the mouth of the river, and about 400 miles above Hankow, which our merchant vessels reach. Small steamboats ply regularly between Hankow and I'chang.

The town is built upon a ledge of conglomerate, the matrix of which is light grey cemented with lime. Mr. Cockburn, to whom I am indebted for his obliging replies to my inquiries respecting these fossils, considers this to be of recent formation, as it lies above the red conglomerate which is found on the opposite bank of the river. This red conglomerate is a pudding-stone, like the old red sandstone of our own coasts.

In summer the river is here rather more than a mile in width,* with a current running often with a velocity of seven knots, and the anchorage for vessels is close to the town; but in winter this is laid bare as an extensive sandflat, on which booths are erected and business of all kinds carried on. The river is then only half a mile wide at its lowest level, and flows close by the south bank at a rate

* A mile and a half.—A. Little, *Journal of the North China Branch of the Royal Asiatic Society*, 1883.

of three knots. At this point there is a striking pyramidal hill 600 feet high, its steepest side descending in an almost vertical cliff sheer into the deep water at the base. On the same side, to the west, is an irregular cliff from 200 to 300 feet high, mostly red sandstone. This formation extends also some fifteen miles down the river. The summer level of the river is usually about 35 feet above the lowest winter level, but occasionally 40 feet, and even more.

In the east and south of China, according to Kingsmill,* "The aqueous formations commence at bottom with a series of coarse grits and sandstones, overlain conformably by limestones and shales. This formation extends from the east coast far into Hupeh, and apparently to the west Sz'chuen, and from the south of Kwantung as far north as the basin of the Yangtse, and probably far north into Mongolia. . . . . Conformably over these grits is a great mass of limestone, containing near its base, in the central provinces at least, a mass of shales of no great thickness, producing coal and iron." The lower bed of this formation, "when exposed, is rendered very conspicuous from the projecting nodules of black chert jutting out far beyond the water-worn and often honey-combed limestone matrix."

The extraordinary extent to which this limestone has been dissolved and washed away, leaving only rugged pinnacles and fantastic rocks, forms a most striking feature in the landscapes of many parts of South China. Those in the gorges of the Si-Kiang river are well illustrated in A. R. Colquhoun's *Across Chrysê*. In one valley in Kwangsi, from ten to twelve miles in breadth, Bickmore counted 192 peaks, some as high as 1,200 feet.

In the lower reaches of the Yangtse, the scenery is tame and uninteresting, but on approaching I'chang a striking change takes place. Ten miles

* *Quart. Journ. Geol. Soc.*, 1869, vol. xxv., p. 119.

below the town the river runs for a mile through a gorge called the Tiger-Teeth Gorge, whose walls are 200 feet perpendicular, and rise in hills for 200 feet higher. Five miles above I'chang the river narrows from half-a-mile to 400 or 500 yards, and for the next hundred miles flows over several rapids and through a succession of limestone gorges (the last one being twenty miles in length), which have been well described by the late Captain Gill in his *River of Golden Sand*, and by the few travellers who have gone through to the West.

"Steep spurs from mountains 3,000 feet high run right down to the water's edge, their sides, where they are not absolutely perpendicular, covered with long orange-brown grass that seems to grow almost without any soil. On the more gentle slopes terrace cultivation is carried on: little patches of the most brilliant green, sometimes a thousand feet above the river and looking almost overhead, showing the presence of some industrious farmer, who will not leave a square yard uncultivated if he can help it. Sometimes the hills are broken with precipices rising 300 feet sheer up from the water, beneath which the river runs with a glossy surface; at other times there are loose piles of débris or gigantic masses of rock strewn about the bed, when the river dashes in wild confusion.* . . . After passing through these deep gorges, where we could seldom see more than a narrow strip of sky, the gentle slopes and open valleys of the province of Szechuen is a pleasant change. The richness and verdure of this part of the country is almost inconceivable. The soil is bright red"—showing the presence of the red sandstone rocks, while this province probably contains the richest coal-field in China.

Up these rapids native boats are tracked at great risk, and a considerable traffic is carried on up and down, but no attempt has yet been made to take

* *River of Golden Sand*, p. 63.

up a steamer, and they form a considerable barrier to the navigation of this mighty river.

The coal and iron shales in Kiangsu in East China contain enormous deposits, and all along the south side of the Yangtse similar deposits occur, in the province of Hunan, and in Hupeh on the north and elsewhere. These coal beds are all interstratified with limestone, and belong to the carboniferous series. The coal in North China, again, is supposed to be of Triassic age.

I may just refer in passing to another interesting formation, the Loess, which is found behind I'chang, in ranges of low hills formed of yellow, friable, sandy soil. "Though almost identical in structure with the Rhine Loess," it "differs widely in position, not being confined to the valleys of the great rivers but stretching almost uninterruptedly over the raised table-lands of Central and Northern China." *

The limestone in which this *Orthoceras* is found extends, according to Mr. Cockburn, over a large tract of country, say from 30 to 40 miles by 10 miles, and perhaps larger, on both sides of a tributary (as large as the Dee at Aberdeen) which falls into the Yangtse three miles above I'chang, or within two miles of the limestone gorges of the great river. It is called the Chang-chias-chee (Long Bridge Creek). There is no bridge in existence now; travellers are taken across in crazy boats, but have usually to wade where fordable, or risk being carried over on the back of a coolie. This creek runs through a very wild country, sometimes forcing its way through gorges, sometimes flowing through small alluvial plains, enclosed by hills on either side like an amphitheatre. The name Pagoda stone is a literal translation of the Chinese, and evidently has arisen from the resemblance the chambers bear to the successive stories in a Pagoda.

Some specimens, but not good ones, are found within ten miles of where the creek joins the

* Kingsmill, *Quart. Journ. Geol. Soc.*, vol. xxvii., 1871.

Yangtse. They are got from the cliffs by the side of the river, but are plentiful in elevated and low positions all over the district, so that good specimens may be picked up by the wayside. The district is wild and mountainous, full of bold cliffs and sharp fantastic peaks.

Though there are coal beds in the province of Hupeh, none are worked within fifty miles of this limestone. As in other countries there must also be numerous faults in these beds, for the coal is exposed at the surface in the gorge of the Yangtse and its affluents in several places,* so that it becomes very difficult to form any accurate idea as to the true position of the limestone in question without more exact evidence as to its relation to the carboniferous or the old red sandstone (Devonian) rocks. Mr. Cockburn has sent a fragment of an *Orthoceras* picked up from the débris at the foot of one of the cliffs, and along with it from the same place a Brachiopod; but from a single species it would be rash to determine whether the *Orthoceras* belonged to the Silurian, Devonian, or Carboniferous beds. In the meantime it must be left, as it stands in the British Museum, labelled "Devonian?" †

The peasants at idle seasons prospect the limestone; and when a fine large *Orthoceras* is found, the stone is cut out in a block, and sawn on the spot into plates or longitudinal sections. They are polished and taken into I'chang, where about half-a-dozen carpenters, in addition to their ordinary business, deal in them. They are then varnished and mounted in carved frames on stands, and are much admired as handsome and appropriate ornaments wherewith to decorate reception-rooms and temples; in the latter they are sometimes inlaid in the floor. The stock in hand is very small, as Mr. Cockburn does

* A. Little, *loc. cit.*

† Since reading this paper I have shown the Brachiopod to Mr. Etheridge, F.R.S., who says it is a *Spirifera*, very like *S. glabra.*

not think the shops among them have ever so many as fifty stones exposed for sale. They are rarely to be met with in the curio-shops of Hankow, and are hardly ever to be seen in those of Shanghai. He says they are not found in the gorges above I'chang, but has heard of many being seen in the rocks in the north-east of the province of Hunan.

The I'chang specimens are all imbedded in a grey limestone, while those referred to by Dr. Hochstetter, and those in the British Museum, are in a dark reddish-brown limestone, and must come from a different part of the country. As one of the latter was purchased in Canton, it is probable that it was brought from some place in the West, perhaps from Yunnan, down the Si-Kiang river to Canton. An imitation article may be picked up in some shops, presumably at a moderate cost; of these there are two examples in the British Museum. They are coloured to represent the limestone, and have an *Orthoceras* painted in the centre with a smaller one on each side of it, and are mounted in a handsome frame.

The largest of the specimens exhibited (Mr. Cockburn's) is $24\frac{1}{2}$ inches in length, and $3\frac{1}{2}$ in breadth at the edge of the chamber, where it has been broken off. It is a central section showing the siphuncle on one surface, but there is no appreciable difference in the breadth on either side. Mr. Dowsley's specimen is $22\frac{1}{2}$ inches in length, and $2\frac{1}{2}$ in breadth at the edge of the broken chamber. It is not a central section, but a slice outside the siphuncle, and the other side of the section is $\frac{1}{4}$ of an inch narrower. Both sections are about $\frac{3}{8}$ of an inch in thickness. The specimen in the University Museum here is 13 inches in length, and $2\frac{1}{2}$ in breadth at the edge of the chamber, and is what I may call the outside slice of the fossil. It is thus a short specimen compared with Mr. Dowsley's, and the latter is narrower throughout than Mr. Cockburn's, and its chambers are more uniform in depth. There is

thus a considerable diversity in the comparative length and breadth of individual specimens, which might amount to a specific difference between them. "Pagoda stone" is a generic name; and any species of *Orthoceras*, from which a good section could be cut, would be called by that name.

The shell has been replaced with greystone not differing from the limestone in which it has been imbedded, but in some places it is darkened, and forms a blackish border; greystone also forms the septa, and the chambers or air-cells are lined or defined with a thread of calcite, which is not so clear as the crystalline spar which fills most of them.

The siphuncle in the larger specimen* can be traced to the apex by transmitted light, and in passing through twelve of the chambers is black or carbonised.

The first or largest chamber (Plate VI., *a* 1), which was occupied by the body of the animal, is $3\frac{1}{2}$ inches in breadth or diameter, and 2 inches in depth, but may have been a little larger; and is filled with greystone similar to the imbedding limestone—that is to say, it is filled with the same mud as that in which the *Orthoceras* was deposited, and contains some small shells or fragments which are seen in the section. Most singularly, a small *Orthoceras* was also deposited when the large one lay probably half imbedded in the mud, and drifted into this chamber in such a way that its apex has touched or entered the siphuncular orifice, and in such a position that the small shell is in a straight line with the siphuncle of the large one. The whole was afterwards covered with mud; and now that a section has been made showing the siphuncle (*s*) of the large one, it displays also a similar section of the small one, with its siphuncle, too, for about one-third of its length. The chambers of the small one are also

* This specimen has been presented to the Museum of the University of Glasgow.

defined by a thread of calcite; were it not for that it would just look like a continuation of the siphuncle of the large one, being in every way quite proportionate.

The next 2¼ inches contain three chambers (*a* 2, 3, 4) filled with spar, except the middle one, which has greystone on the outer half of one side. In the first two of these chambers, the septum (*d*) is seen to project for a short distance towards the concavity of the preceding chamber, and in the next (*a* 4) has surrounded the siphuncle (*s*) in a short tube. This projection is not seen with any distinctness in any of the other chambers, with the exception of the seventeenth. Dr. Woodward's plate* shows this shelly prolongation still more clearly. It is similar to what is seen in the Pearly Nautilus, where a small tube projects into all the chambers.

The fifth chamber has spar only on one side of the siphuncle; the sixth is altogether filled with spar; while the seventh has spar only on the outer half of one side. The next five chambers are filled with spar.

The thirteenth is 2 inches in breadth and 1 in depth, and is entirely filled with greystone, but on the opposite side it is filled with spar to the extent of one-half. The siphuncle (*s*) in this chamber is lined on both sides with the thread of calcite, and this white thread appears to enclose the siphuncle throughout its entire length. The septum (*d*) of greystone is well seen, being bordered with the thread of calcite.

Between the thirteenth chamber and the apex, the siphuncle and the division into chambers become gradually less distinct, as they are all filled with spar; but on being held up before the light, the transparency of the spar, which also fills the next four chambers, permits them to be seen, and that still more clearly after wetting the part. In the three following (*a* 18-20), the interior of the chamber has

* *Loc. cit.*

become contracted into something like the form of a broad-arrow barb (*b*) on each side of the siphuncle, the intervening space (*c*) between the outer shell and the lining membrane of the chamber being filled with spar; and the same can be seen more or less distinctly in the next four smaller chambers (*a* 21-24). The part which forms the barb of the arrow has a black margin surrounding a clear central sparry portion. Dr. Woodward's plate shows the same separation and contraction of the lining membrane of the chamber. When the specimen is held up before a bright gas-flame, this is all seen more distinctly, and the siphuncle and division into chambers can be traced to the apex of the shell. In these latter the contraction of the chambers has gradually increased till the section represents only a small projection on each side of the siphuncle.

In Mr. Dowsley's specimen the chambers are more uniform in size. The broken one at the edge is filled with spar; in the next two it is mixed with greystone; while the next two, and on the other side all four, are filled with spar. The three following are filled with greystone, and have the chambers defined by the thread of calcite, and the intervening septum by greystone; on the opposite side they are partly filled with spar. The next four (10th, 11th, 12th, and 13th) are filled with greystone, and are all lined with the thread of calcite, with the septum in greystone between them. On the other side one-third of the 10th, and the whole of the 11th, is filled with greystone; while the 12th and remaining chambers to the apex are filled with spar and are more or less hazy, but on wetting the stone the septa of the chambers are all brought out, and even a portion of siphuncle is seen on the 18th and three following chambers. The last $2\frac{1}{2}$ inches to the apex are transparent.

This beautiful tapering specimen would probably be two or three inches longer, and not being disfigured, as I might say, by the siphuncle, would, I

fancy, be considered by the Chinese as by far the finer and more valuable of the two for ornamental purposes. Though the surface is quite smooth, it could easily be polished to a higher degree, and when suitably framed might be admired even in a Western drawing-room.

The *Orthoceratidæ* were pre-eminently palæozoic Cephalopods. Some of them survived into the mesozoic period, but none of their remains are found later than the Trias. They are a sub-family of the *Nautilidæ*, of which only a single well-known species, *Nautilus pompilius*, the Pearly Nautilus, and one or two rarer ones, have survived to the present day. The only other Cephalopods extant with an external shell form the genus *Argonauta*, of which there are some half-dozen species, notably *A. argo*, the Argonaut or Paper Nautilus, but the shell has only a single chamber, and is quite external to the animal, not being organically connected, but secreted by the webbed appendages of the female, while the male has no shell.

The Pearly Nautilus *(N. pompilius)* has a true pallial shell, divided by septa, like so many bulk-heads, into chambers, the animal occupying only the first or outside one of the spiral, while the nutrition of the whole is kept up by the vessels of the siphuncle passing through the centre of them all. These unoccupied chambers are supposed to be filled with air or gas, making the shell more buoyant. Only one specimen was got by the *Challenger* Expedition. It was dredged off Levuka, one of the Fiji Islands, in 315 fathoms, on a coral bottom.

"The animal was very lively, though probably not so lively as it would have been from a less depth, the sudden change of pressure having no doubt very much disarranged its economy. However, it swam round and round a shallow tub in which it was placed, moving after the manner of all Cephalopods backwards, that is with the shell foremost. It floated at the surface with a small portion of the

top of the shell just out of the water, as observed by Rumphius. The shell was maintained with its major plane in a vertical position, and its mouth directed upwards. The animal seemed unable to sink, and the floating of the shell, as described, was due no doubt to some expansion of gas in the interior, occasioned by diminished pressure. The animal moved backwards slowly by a succession of small jerks, the propelling spouts from the siphon being directed somewhat downwards, so that the shell was rotated a little at each stroke upon its axis, and a slightly greater area of it raised above the surface of the water. Occasionally, when the animal was frightened or touched, it made a sort of dash by squirting out the water from its siphon with more than usual violence, so as to cause a strong eddy on the surface of the water. On either side of the membranous, operculum - like headfold, which when the animal is retracted entirely closes the mouth of the shell, the fold of the mantle closing the gill cavity was to be seen rising and falling with a regular pulsating motion, as the animal in breathing took in the water, but which was afterwards expelled through the siphon. The tentacle-like arms contrast strongly with those of most other Cephalopods, because of their relatively extreme slightness and shortness, though they are not shorter proportionally than those of the living *Sepia*. They are held by the animal whilst swimming extended radially from the head, somewhat like the tentacles in a sea anemone; but each pair has its definite and different direction, which is constantly maintained. This direction of the many pairs of tentacles at constant but different angles is the most striking feature to be observed in the living Nautilus. Thus, one pair of tentacles was held pointing directly downwards; two other pairs, situated just before and behind the eyes, were held projecting obliquely outwards and forwards,

and backwards respectively, as if to protect the organ of sight. In a somewhat similar manner the tentacular arms of the Cuttlefish whilst living are maintained in a marked and definite attitude, as may be observed in any aquarium." *

We may conclude that the animals of the fossil *Nautilidæ*, whether they had a straight shell like *Orthoceras*, or an involute shell like *Nautilus*, were not unlike in structure and habits to the living species. They kept to the bottom of the sea, and were able to propel themselves for some distance, assisted by the buoyancy of the air-chambers. The increase in the size of the chambers in *Nautilus* is much greater in proportion to those in *Orthoceras*, and from the small size of these in the latter, as compared with the length of the shell, it is difficult to form an idea of what may have been the size of the body of the latter animal. One would fancy the owner of a six-feet shell (and some are believed to have been longer than that) would be a large and powerful fellow, yet the diameter of his body-chamber would not be much over ten inches, and if he could retract himself into it, as reported of *Nautilus*, he may not have been so very big after all.

* *Narrative of the Cruise of the Challenger*, Vol. I., part i., p. 490

Explanation of the Plate.

Plate VI.

Orthoceras sp.; longitudinal section $\frac{2}{3}$ nat. size.

a, *a*, air-chambers numbered in succession 1, 2, 3, &c.
b, the same contracted. *c*, intervening space.
d, septum. *s*, siphuncle.

In executing the drawing the aid of transmitted gas-light was used.

PROCEEDINGS

OF THE

NATURAL HISTORY SOCIETY OF GLASGOW.

SUMMER SESSION, 1883.

THE SOCIETY'S ROOMS, 207 BATH STREET.

15TH MAY, 1883.

Mr. Peter Cameron in the Chair.

Mr. Robert Turner reported that an excursion had been made on 12th inst. to Thornliebank and neighbourhood. On account of the coldness of the season, comparatively few flowering plants were observed; the most noteworthy being *Corydalis claviculata*, DC., and *Viola odorata*, L., found near Eastwood Park; *Arum maculatum*, L., observed growing at a hedge-root in the policies; and *Omphalodes verna*, a hardy garden perennial, which had established itself in the Rouken Glen and was apparently quite naturalized.

Mr. James J. F. X. King exhibited an almost complete collection of British *Trichoptera*, *Neuroptera-Planipennia*, and *Macro-Lepidoptera*.

The Chairman (Mr. Cameron) showed an interesting collection of hymenopterous leaf-galls, with the gall-producing insects themselves in their various stages of development.

Mr. Peter Ewing exhibited the following species of *Hepaticæ*, collected by him in the localities mentioned, viz.:

Frullania germana, Tayl.—Campsie.
Porella lævigata, Schrader.—Campsie.
Cephalozia albescens, Hook., var. *scotica*.—Ben Laoigh.
C. Lammersiana, Hübn.—Loch Lomond.
Jungermannia Flœrkii, W. and M.—Cumbernauld.
Fossombronia cæspitiformis, De Not.—Cumbernauld.
Pellia calycina, Tayl.—Campsie.
Metzgeria linearis, (Sw.) Lindbg. — Rumbling Bridge, Kinross-shire.
M. conjugata, (Dill.) Lindbg.—Rumbling Bridge, Kinross-shire.

Mr. Ewing stated that *Cephalozia Lammersiana*, Hübn., *Fossombronia cæspitiformis*, De Not., and *Metzgeria conjugata*, (Dill.) Lindbg., were new to the Scottish Flora, and that the others were now for the first time recorded for the districts in which they had been gathered.

An exhibition of microscopic objects afterwards took place.

29TH MAY, 1883.

Mr. Robert J. Bennett in the Chair.

Mr. D. A. Boyd reported that an excursion had been made to Paisley on 26th inst. At Nethercraigs the artificial fish-ponds adjoining Messrs. J. & P. Coats' works were visited, and the various appliances for hatching and rearing the young fish examined. The capsules of *Thamnium alopecurum*, L., a moss not often found in fruit in the district, were observed on moist rocks at the Gleniffer Braes.

Mr. Peter Cameron exhibited specimens of *Trientalis europæa*, L., and *Paris quadrifolia*, L., from a glen near Johnstone, and stated that these plants had not been previously recorded for that district.

Mr. James Coutts exhibited a collection of Butterflies from Western Africa, gathered by the late Mr. George Thomson, formerly a member of the Society. He also showed a series of specimens, reared by himself, of the Silk Moth.

Mr. Joseph Sommerville exhibited some fine specimens of the Fresh-water Sponge, *Spongilla fluviatilis*, found in considerable numbers adhering to logs in the Forth and Clyde Canal at Port Dundas Timber-Basins, Glasgow.

Mr. Peter Cameron exhibited several cases of Insects collected for Messrs. F. Duncan Godman, and Osbert Salvin, in Central America. The collection represented almost all the families of the *Hymenoptera*, and included some very interesting Wasps' nests.

Mr. Cameron then read a paper on "Mimicry." In the course of some introductory remarks on the historical aspect of the subject, he referred to the observations made by the earlier naturalists on the resemblance of many insects to certain organic or inorganic substances. These naturalists, however, had not attempted to give any explanation of such cases beyond noticing the apparent protection thus afforded to the insects from their enemies. After the publication of Mr. Darwin's *Origin of Species* in 1859 the subject acquired fresh interest, and Messrs. Wallace and Bates drew special attention to it by their researches. Mr. Cameron discussed the various theories which had been stated with the view of explaining this

class of phenomena, all of which he regarded as unsatisfactory as they did not get over the question of how the first markings and variations of the insects had originated.

12TH JUNE, 1883.

Mr. James J. F. X. King in the Chair.

Mr. Richard M'Kay reported that an excursion had been made to Cardross on 9th inst. *Valeriana pyrenaica*, L., was found growing on the banks of the Darleith Burn; and several mosses, including *Physcomitrium pyriforme*, B. and S., and *Fontinalis antipyretica*, L., were gathered in fruit.

The Chairman (Mr. King) exhibited a variety of *Mesophylax aspersus*, Ramb., an addition to the British *Trichoptera* recently taken by Mr. R. Service at Maxwelltown, near Dumfries. This insect forms an interesting addition to our Fauna in respect that while the type of the species is only found in the south of Europe, the variety, which is smaller in size, has been noticed as far north as Bavaria.*

Mr. Robert Turner read a paper on Dr. Robert Morison, a Scottish botanist, who was born at Aberdeen in 1620, and was for fourteen years Professor of Botany in Oxford University.

26TH JUNE, 1883.

Mr. Peter Cameron in the Chair.

Mr. Richard M'Kay reported that an excursion had been made to Possil Marsh on 19th inst., when *Carex teretiuscula*, Good., which is rare in the district, was found on the east side of the Marsh.

Mr. D. A. Boyd reported on an excursion made to West Kilbride on 23rd inst. He also exhibited several very large specimens of *Trifolium striatum*, L., with many branches more than 12 inches in length, and remarked that although the shores of the Firth at West Kilbride seem at present to be the northern limit of the distribution of this plant on the West Coast, it is in all probability gradually extending northwards. While common on the East Coast of Britain, it was not known until recent years to grow north of the Solway on the West; but from the way in which the plant had now established itself and was spreading at West Kilbride, and the luxuriance of the specimens exhibited, it seemed well fitted to maintain its footing in the locality.

* This supposed variety has since been raised to the rank of a species under the name of *Mesophylax impunctatus*, M'Lach.

Mr. Boyd also exhibited specimens of *Arena pubescens*, L., from the same district, and remarked, that although found in abundance at Portincross, and also at Seamill, where the specimens exhibited had been gathered, the plant is very local in the western counties of Scotland. It is described in Mr. Hennedy's *Clydesdale Flora* as "very rare," and only two Clydesdale stations are there recorded for it.

31st July, 1883.

Mr. Peter Cameron in the Chair.

Mr. D. A. Boyd reported that on 5th inst. the members of the Society had visited the Royal Botanic Gardens by permission of the Directors, when they were conducted through the plant houses by Mr. Robert Bullen, Curator of the Gardens, and by Professor Bayley Balfour, M.D., D.Sc., who kindly pointed out and described many of the rarer exotics.

Mr. John Broom reported on an excursion which had been made to Millport on 28th inst.

Mr. R. Turner submitted the following list of plants observed on the Lesser Cumbrae in the course of a few hours' botanizing on that island on the same date, viz.:

Ranunculus acris.
Caltha palustris.
Glaucium luteum.
Silene maritima.
Lychnis dioica.
L. Flos-cuculi.
Stellaria graminea.
Erodium cicutarium.
Agrimonia Eupatoria.
Potentilla anserina.
Ribes Grossularia.
Sedum anglicum.
Cotyledon Umbilicus.
Parnassia palustris.
Carum verticillatum.
Conium maculatum.
Galium palustre, var. *Witheringii.*
G. Aparine.
Cnicus lanceolatus.
C. palustris.
C. arvensis.
Arctium Lappa.
Bellis perennis.
Campanula rotundifolia.
Solanum Dulcamara.
Digitalis purpurea.
Veronica Chamædrys,
Euphrasia officinalis.
Prunella vulgaris.
Scutellaria galericulata.
Teucrium Scorodonia.
Myosotis arvensis.
M. versicolor.
Lycopsis arvensis.
Urtica dioica.
U. urens.
Iris Pseudacorus.
Juncus communis.
J. glaucus.
J. maritimus.
J. bufonius.
Pteris aquilina.
Blechnum spicant.
Asplenium Adiantum-nigrum.
A. Trichomanes.
Coprinus atramentarius.

Mr. M. C. Duff gave an account of a recent visit to the Clova district, and exhibited fresh specimens of *Lychnis alpina*, L., gathered on Little Kilrannoch, and other rare alpine plants.

Mr. D. A. Boyd exhibited specimens of *Carex limosa*, L.,

gathered by him in a small marsh on the east side of Knockewart Hill, near Ardrossan, and made some remarks on the distribution of the species.

The Chairman (Mr. Cameron) exhibited specimens of several species of *Tenthredinidæ*, including *Dineura stilata*, Klug., a species remarkable for the variation shown in the neuration of the wings. He stated that the majority of the specimens found have only one radical cellule, and are practically species of the genus *Nematus*, this form having indeed been recently described as a new species of *Nematus* by Brischke and Zaddach. The obliteration of certain nervures appears to have been caused by the enlargement of blister-like spots, found in a more or less developed state in most *Tenthredinidæ*, and formed in all probability by the manner in which the undeveloped wings were folded in the pupa. As about 70 per cent. of the specimens of *Dineura stilata*, Klug., have only one radical cellule in the fore wings it is conceivable that in a comparatively short period all the individuals will be in that condition, and will then require to be transferred to the genus *Nematus*, from which *Dineura* only differs in having two radical cellules. From the point of view of evolution, therefore, the species is of much interest, as it shows how what we call "genera" have been formed, in this case apparently by mechanical causes acting in an earlier stage of the creature's existence. Mr. Cameron also exhibited a *Nematus* bred from a green larva on the hawthorn, and apparently identical with a species figured but not described by Brischke and Zaddach under the name of *Nematus cratægi*; also living larvæ of *Nematus cadderensis*, Cam., from Possil Marsh, where they were found feeding on the leaves of *Salix pentandra*, their usual food being the leaves of the birch.

Mr. William Goodwin read a paper on "Double-staining Vegetable Tissues." After referring to the various methods of preparing tissues by the double-staining process, he described fully the system of manipulation which he had found to be most practicable. When the sections had been cut, they could be preserved for a considerable time if kept immersed in spirit diluted with water. The first step in the process was bleaching. Sections which were little coloured might be bleached by immersion in spirits of wine, but if more highly-coloured it was necessary to treat them with a chlorine solution, the well-known "ozone bleach" being well adapted for the purpose. They must afterwards be thoroughly washed, otherwise they would gradually fade after having been dyed; and when perfectly free from the chlorine solution they might be put into a weak spirit until ready for the next process, which was dyeing with carmine. Before dyeing it was necessary to use a mordant—a five-per-cent. solution of acetate of alumina

being the most suitable. The sections, after having been soaked in this solution for a night, should then be immersed for about twenty minutes in a solution of carmine. When removed from the carmine they should be thoroughly washed—first with water, to which a few drops of acid had been added, to neutralise the ammonia, and afterwards with pure water. At this stage they would have acquired a bright pink colour. They should then be dyed in an aniline dye, "iodine-green" being most suitable, in the proportion of three grains to an ounce of alcohol. In this solution the sections should remain for a night, and afterwards be washed in absolute alcohol for a minute or so, according to circumstances. They should next be immersed in oil of cloves, in which they would acquire perfect transparency, and might then be mounted with a solution of balsam in benzine. In illustration of the process which he had described, Mr. Goodwin exhibited under the microscope several slides prepared in the manner indicated.

14TH AUGUST, 1883.

Mr. George R. Alexander in the Chair.

Mr. Joseph Sommerville reported that an excursion had been made on 8th inst. to the Forth and Clyde Canal at Port-Dundas and Firhill Timber-basins. Fresh-water Sponges (*Spongillæ*) were found adhering to the timber-logs, several aquatic molluscs were collected, and the three rarer species of Duckweed (*Lemna trisulca*, L., *L. gibba*, L., and *L. polyrhiza*, L.) were obtained. Mr. Sommerville exhibited a *Spongilla* which had been washed with weak acid so as to leave exposed the skeleton of white, siliceous spicules.

Mr. James Steel submitted the following list of Fresh-water *Mollusca* observed in the Timber-basins, viz.:

Sphærium corneum, L.—Common.

Dreissena polymorpha, Pallas.—Common, and found in all stages of growth from the fry upwards. This shell, which occurs as an upper tertiary fossil in the north of France, was not observed in Britain till 1824. Dr. Jeffries is inclined to regard the species as indigenous.

Bythinia tentaculata, L.—Common.

Valvata piscinalis, Müll.—Frequent. Remarkable for the feather-like branchial appendages.

Planorbis albus, Müll.—Common.

Physa fontinalis, L.—Common.
Limnæa peregra, Müll.—Common.
L. auricularia, L.— } Local in England, and exceeding-
,, var. *acuta* (?) } ly rare in Scotland. Dr. Jeffreys says: "It is local, and does not satisfactorily appear to have been found in Scotland."* It has been taken in the Glasgow and Paisley Canal by Mr. Thomas Scott of Greenock.† The specimens from the Timber-basins include both the typical form and a variety which approaches very nearly to var. *acuta*.

Mr. R. Turner gave an account of a recent visit to Luce Bay, Wigtonshire, and made some remarks on the Botany of that district.

The Chairman (Mr. Alexander) exhibited a small collection of Swiss plants; Mr. Peter Ewing, specimens of *Rhinanthus major*, Ehr., and *Mertensia maritima*, Don, from the neighbourhood of Kilconquhar, Fifeshire; and Mr. William Gemmell specimens of *Sambucus Ebulus*, L., which still grows on the roadside between Carmunnock and Kittochside as recorded by Ure in 1793.

Mr. Peter Cameron exhibited part of his collection of Parasitic Cynipidæ, including 14 apparently undescribed species, which he named as follows:

Allotria ruficollis, Cam.—Mull.
A. ruficeps, Cam.—Galloway.
A. mullensis, Cam.—Mull.
A. salicis, Cam.—Kilpatrick Hills. Bred from an Aphis on *Salix pentandra*.
A. curvicornis, Cam.—Glen Lyon.
A. piceomaculatus, Cam.—Dumfries.
Melanips femoralis, Cam.—Gloucester.
Trybliographa nigricornis, Cam.—Cadder and Dumfries.
T. testaceipes, Cam.—Cambuslang and Dalry (Ayrshire).
Psicharca glottiana, Cam. ,, ,,
P. gracilicornis, Cam. ,, ,,
Ægilips ruficornis, Cam.—Bishopton.
Æ. striolata, Cam.—Clober.
Æ. scotica, Cam.—Glen Morriston.

Mr. Joseph Sommerville exhibited living specimens of a large American Ant, *Formica pennsylvatica*, De G., a nest of which had been found in a log of yellow pine recently received in Glasgow from Michigan, U.S. The species is very widely dis-

* *Brit. Conch.* v. 109. † *Proceedings*, v. 311.

tributed, being found in North America, Siberia, China, and Japan. Its habits and architecture have been described in detail by Rev. H. MacCron.

Mr. John Broom read an interesting paper on "Plant Names," in which he gave an historical sketch of the nomenclature of plants, and traced the origin and meaning of many of the common names by which they are known in this and other European countries.

28TH AUGUST, 1883.

Mr. R. Turner in the Chair.

Mr. Peter Cameron reported on an excursion made to Milngavie and neighbourhood on 25th inst. The Red Whortleberry, *Vaccinium Vitis-Idæa*, L., which had not before been recorded for any station nearer Glasgow than the Kilpatrick Hills, was found in the Dougalston Woods; and *Lycopus europæus*, L., was collected on the edges of the artificial ponds. The yellow flowers of *Nuphar pumila*, DC., were seen on the surface of Bardowie Loch, but could not be reached from the shore.

Mr. Cameron exhibited a *Lycopodium* which had been employed in packing entomological specimens received by him from Guatemala, where the plant is used by the natives for food.

Dr. James Stirton, F.L.S., exhibited some fine specimens of *Merulius lacrymans*, Fr., in its fruiting state; and he made some remarks on the best methods of eradicating this destructive fungus.

Mr. Cameron read a paper on "The Origin of the Forms of Galls,"* which he illustrated by means of an ample series of native and foreign specimens.

11TH SEPTEMBER, 1883.

Mr. Peter Cameron in the Chair.

Mr. James C. Christie reported on an excursion made to the Hamilton district on 8th inst. *Polyporus dryadeus*, Fr., a fungus new to the district, was found on an old oak in the gardens at Barncluith. Fungi were abundant in Cadzow Forest, and among the species observed were *Amanita rubescens*, P., *Tricholoma rutilans*, Schæff., *Lactarius blennius*, Fr., *Russula emetica*, Fr., *Boletus edulis*, Bull., *B. chrysenteron*, Fr., *Fistulina hepatica*, Fr., *Tremella mesenterica*, Retz., &c.

* *Transactions*, i. 28.

Mr. Joseph Sommerville exhibited specimens of *Blatta americana*, an American cockroach which has become naturalized in this country. The specimens were found concealed in crevices in a mahogany log.

The Chairman (Mr. Cameron) exhibited specimens of *Nematus oblongus*, Cam., from the Kilpatrick Hills, and remarked that the species, which is new to the Scottish Fauna, is of very rare occurrence in England. He also exhibited specimens of a Leaf-fungus, *Rœstelia cornuta*, Tul., and stated that at Thornhill, Dumfriesshire, the fungus is very common on the leaves of *Pyrus Aucuparia*. In its alternate state, formerly described as *Gymnosporangium juniperi*, it is also abundant on the Juniper. Dr. T. B. Grierson, of Thornhill, had informed him that at present the leaves of the Rowan-trees in his garden are covered with the fungus, and that the form which occurs on the Juniper is destructive to the branches on which it grows. Mr. Cameron also exhibited gall-like excrescences found on the roots of the Ivy and Alder, upon which he made some remarks.

Mr. William Goodwin described the processes in Micro-photography, and exhibited the entire apparatus necessary, which was of a simple and inexpensive description. As a practical illustration of the method, he afterwards photographed an object which he had placed under the microscope.

WINTER SESSION, 1883-84.

THE THIRTY-SECOND ANNUAL GENERAL MEETING,

25th September, 1883.

Mr. John A. Harvie-Brown, F.R.S.E., &c., President, in the Chair.

Mr. James Coutts referred to the loss which the Society had sustained through the death of Mr. George J. Combe, one of the Members of Council.

The Treasurer, Mr. Robert J. Bennett, submitted his Annual Financial Statement, which showed a balance due to him of £14 0s. 11d. The Statement, Mr. Bennett explained, did not include the Life Members' Subscriptions; and, with the view of increasing the Society's funds, he recommended that the entry-money should be altered to 7s. 6d., and the annual subscription increased to 7s. 6d.

The Secretary read the Report of the Council on the business of last Session.

Report of the Council.

The Council beg to report that the number of new members added to the Roll of the Society during the past Session was 32, being two more than in the previous year. The total number at present on the Roll of the Society is 9 Honorary, 29 Corresponding, and 246 Ordinary Members, giving a total of 284, or 14 less than at the beginning of last Session. After allowing for deaths and resignations, the difference is accounted for by the careful purging of the Roll, and the removal of the names of those who had ceased their connection with the Society, so that a new and more perfect list of Members might be issued.

In their obituary the Council have to record with regret the name of Mr. George J. Combe, a Member of Council, who was connected with the Society for a period of seventeen years. Mr. Combe took a warm interest in all that pertained to the Society's welfare. He was a regular attender at the meetings, and contributed occasionally to the proceedings—the last specimens exhibited at the closing meeting of the past Session being shown by him.

The usual number of meetings were held during the Session, and were well attended, the average number of members pre-

sent being 70. The papers read and specimens exhibited were barely up to the average of past years in point of number; but in scientific interest they were quite equal to those of previous Sessions, and covered many of the branches of the Animal and Vegetable Kingdoms. While Botany and the Vertebrate Animals were well represented, the Council would point out to the members the absence of many of the lower groups from the exhibitions and papers, and would suggest that attention be paid to these as rich fields of research for the scientific worker.

The Museum Committee have handed over to the Parks and Galleries Committee of the Town Council of Glasgow portions of the Reference Collections being prepared by them, and which are intended to be placed in the Kelvingrove Museum. These comprise large collections of Flowering-plants and Mosses, and a collection of Neuroptera. The Council would urge the members of the Society to assist the Museum Committee in their efforts to provide reliable collections of Plants and Invertebrates or the assistance of their fellow-workers in Botanical and Zoological science.

Another part of the Society's *Proceedings* will shortly be issued to the members, bringing the work up to the close of the Session 1881-82. The remaining part, which includes the proceedings up to the end of last Session, is also in the press, and will be pushed on with all possible despatch.

Short notices of the meetings were regularly sent to the Glasgow newspapers, so that the work of the Society might be brought prominently before the public.

In conclusion, the Council trust that the members will endeavour to make the coming Session of even greater importance than any in the past, both for the benefit of science and of the Natural History Society of Glasgow.

Mr. Peter Cameron, Convener of the Museum Committee, read the Report of the Committee on the work done in preparing the collections to be deposited in the Kelvingrove Museum. 544 specimens of Mosses and 60 species of Neuroptera had been handed over to the Museum authorities.

Mr. James J. F. X. King, Convener of the Library Committee, reported: That the books in the library are in good condition, and have been much used during the past year, the issue of books during the Winter Session being 113 volumes, and during the Summer 66 volumes—in all 179 volumes, as compared with 169 during Session 1881-82.

During the year about 380 separate publications, of which only 5 were purchased, have been added to the Library.

The Library contains 532 volumes in circulation, besides a large number which, owing to their unbound condition, it is not advisable to lend out.

In the early part of the Summer Session the Library Catalogue was issued by the Committee. In this Catalogue is noted all the books, pamphlets, &c., whether bound or unbound, contained in the Library.

Vol. v., Part i., of the Society's *Proceedings* has been sent to 98 Societies, Institutions, and Magazines, from which, in most cases, an adequate return has been received.

Mr. D. A. Boyd, Summer Secretary, read a Report on the Proceedings of the Summer Session. The usual number of meetings and excursions had been held, many interesting specimens having been exhibited and papers read.

The Reports were all unanimously adopted.

The Society then proceeded to the election of Office-bearers, when Mr. Peter Cameron was elected a Vice-President, and Messrs. R. Turner, D. A. Boyd, George R. Alexander, W. J. Milligan, and D. Gregorson, Members of Council,—the Council being as follows: President, John A. Harvie-Brown, F.Z.S., F.R.S.E., &c.; Vice-Presidents, Professor John Cleland, M.D., F.R.S., Robert Mason, and Peter Cameron; Secretary, John M. Campbell; Treasurer, Robert J. Bennett; Librarian, James J. F. X. King; Members of Council, W. J. Milligan, D. Gregorson, M. C. Duff, J. B. Murdoch, F.S.A.Scot., Richard M'Kay, Peter Ewing, R. Turner, D. A. Boyd, and George R. Alexander.

30TH OCTOBER, 1883.

Mr. Peter Cameron, Vice-President, in the Chair.

Messrs. John Davies, 3 Park Terrace, Langside; Patrick Macfarlane, 70 Great Western Road, Hillhead; and Oswald Fergus, 3 Elmbank Crescent, were elected Ordinary Members.

The Chairman intimated that the Council had appointed Mr. D. A. Boyd, who had acted as Secretary during last Summer Session, to be Secretary of the Society in room of Mr. John M. Campbell, resigned.

Mr. Thomas King exhibited some Fungi, including *Agaricus phalloides*, *A. imbricatus*, *A. granulosus*, *Hygrophorus hypothejus*, *H. coccineus*, *H. pratensis*, *Cantharellus cibarius*, and *Peziza vesiculosa*. He made some remarks on these species, and exhibited under the microscope sections of *Peziza vesiculosa*, showing the *asci* in which the spores are borne.

The Chairman read a paper on "Zoology," in which he referred at some length to the various departments of the science, and described some interesting phenomena of animal life.

Mr. R. Turner read a paper on the "The Green Colour of Plants," which he illustrated with a diagram representing the distribution of chlorophyll in the leaf-cells of different plants, and with preparations showing the composition of the green colouring matter.

27TH NOVEMBER, 1883.

Mr. Peter Cameron, Vice-President, in the Chair.

The following were elected Ordinary Members, viz.: Messrs. Charles Elder, 212 St. Vincent Street; James Brownlie, Victoria Saw-mills, Port-Dundas; Thomas G. Bishop, Craven House, Windmill Road, Hamilton; John H. Ferguson, 22 Arlington Street; James B. Paul, 96 Buchanan Street; Frank Coulson, Greenhead Brewery; and Robert Broom, 88 North Hanover Street.

The Chairman intimated that the vacancies which had occurred in the Council since the Annual General Meeting had now been filled up as follows: President, James Stirton, M.D., F.R.C.S.Ed., F.L.S.; Vice-Presidents, Rev. A. S. Wilson, M.A., B.Sc., and Henry E. Clark, M.R.C.S.; Treasurer, M. C. Duff; Members of Council, James Dairon, F.G.S., John Robertson, and James Steel.

Mr. R. Turner exhibited Flowers and Pods of Sea-Island Cotton, *Gossypium barbadense*, from the United States. In the course of some remarks on these specimens he stated that four species of the Cotton-plant were recognised by botanists. The first, *G. arboreum*, of India, was cultivated in groves around the Hindu temples, and afforded the Brahmins the material for the manufacture of their "holy thread." This was probably the earliest use to which cotton had been applied by the Indians. Herodotus described them as making cloth from a wool which grew on trees, and from his description it would appear that the manufacture of cotton was at that time unknown to the Egyptians. The second species, *G. herbaceum*, which is now principally used in manufacture, is grown extensively throughout the East, having of late years been introduced into India and Egypt. The third species, Brazil cotton, *G. peruvianum*, differs in having its seeds joined together inside the floss. It is almost equal in value to the Sea-Island cotton, and brings a high price in the market. While the Sea-Island cotton grows best near the sea coast, the Brazil cotton is more productive in inland districts. The fourth species, Sea-Island cotton, *G. barbadense*, was introduced into the United States from the Bahama Islands. It was first grown in Georgia, and attempts were afterwards made to cultivate it in the uplands,

with the result that an inferior quality, known as "Upland cotton," was produced. Mr. Turner also stated that the manufacture of cotton had apparently been carried on in Peru at a much earlier date than in Egypt, the mummies discovered in Peru being always wrapped in cotton cloth, while those found in Egypt were wrapped in linen.

Mr. Turner also exhibited a few heads of Carolina Rice, and remarked that much of the "Carolina Rice" sold in this country was Java rice, to which the glossy appearance of the former had been imparted by wax.

Mr. M. C. Duff exhibited two large cases of Butterflies and Moths collected last summer at Garelochhead.

Mr. Thomas King exhibited specimens of plants collected by him on the chalk downs at Purleigh, Surrey, including *Malva moschata*, *Asperula cynanchica*, *Scabiosa columbaria*, *Phyteuma orbiculare*, *Verbascum nigrum*, and *Verbena officinalis*.

The Chairman (Mr. Cameron) exhibited specimens of several rare Ichneumons, including *Oresbius castaneus*, Marsh., an Alpine species from the top of Goatfell, Arran; *Hemiteles marginatus*, Bridg., a recently described species, bred from cocoons of *Apanteles sericeus*, a parasite on a caterpillar which feeds on the juniper at Milngavie; and *Phrygadeuon tarsatus*, Brid., a recently described species, from Lamlash, Arran.

Mr. Cameron also exhibited some dead larvæ of *Dolerus fissus*, received from Mr. G. T. Porrit, who had found thousands of these larvæ on grass in a wood in the Isle of Man. Most of them were adhering to the grass by their mandibles, in their natural position when feeding. Mr. Cameron stated that the species was a common one on grass; and the only suggestion he could offer as to how so many of the larvæ had been killed was that a sharp and sudden frost had been the destroying agent.

The following papers were read, viz.: "On the Habits of *Euura (olim Cryptocampus)*," by Mr. Peter Cameron;* "On the Occurrence of *Microdon mutabilis*, Lin., in the West of Scotland," by Mr. Peter Cameron;† "Swallows: some instances of their Retarded Migration," by Mr. William Craibe Angus.‡

18th December, 1883.

Dr. James Stirton, F.L.S., President, in the Chair.

Messrs. John Freeland Fergus, 3 Elmbank Crescent, and John Irvine, Saracen Foundry, were elected Ordinary Members.

Mr. Henry E. Clark, M.R.C.S., Vice-President, exhibited specimens of Fossils from South Carolina. They were brought

* *Transactions*, i. 38. † *Id.*, i. 42. ‡ *Id.*, i. 92.

up in the process of dredging the rivers for phosphates, and consisted of teeth of a gigantic species of shark, bodies of vertebræ of a whale, portion of a tusk of Mastodon, and fragments of bones not capable of definite identification. The shark's teeth were of great size and very perfect, the surface layers being quite intact in all but two of the specimens, and the serrations of the edges unbroken. From a comparison of these with the plates and descriptions in Agassiz' *Recherches sur les Poissons Fossiles*, Mr. Clark was able to refer them to the species *Carcharodon Megatodon*, although the specimens exhibited exceeded in size any of those of which the measurements were given by Agassiz. The largest measured 5 inches from base to tip, and 4½ inches in width at its widest part. If the tooth bore the same relation to the length of the body that it does in existing species, it might be assumed that the species to which these teeth belonged were not less than 150 feet in length. Mr. Clark, however, pointed out that a calculation such as this must be regarded rather as an ingenious speculation than as an ascertained fact, for it was not found that the relation referred to was by any means constant or reliable. Specimens of such teeth are to be found in many museums; but it is rare to find them quite perfect, and examples so large as those exhibited are seldom met with.

Mr. Peter Cameron, Vice-President, exhibited a collection of Ants made in the mountains of Ecuador by Mr. Edward Whymper, the Alpine climber. The collection, which numbered about 18 species, included several which are common in South America; *Camponatus marginatus*, Latr., found in North America, Europe, and North Asia; and *Ponera carbonaria*, Smith. Five or six of the species were apparently undescribed, and among these was a remarkable new genus allied to *Ponera* in the structure of the abdomen, but having the head not unlike *Cryptocerus*.

Mr. Cameron also exhibited the various forms of the South American Foraging Ant *(Eciton)*, and Leaf-cutting Ant *(Atta)*, and described the remarkable habits of these insects. The latter is one of the most destructive insects in South America. It destroys trees, especially the cultivated kinds, by denuding them of their leaves, which are carried in small pieces by the ants to their nests and there heaped up in masses. The ants do not feed on the leaves themselves, but use them merely as a soil for growing fungi, which appear to form their principal food. The foraging ant, on the other hand, is rather a useful species, as it feeds entirely on other insects. In certain districts immense numbers of these ants invade the houses at particular seasons, and thoroughly clear them of insects and other vermin.

Mr. John Renwick exhibited a number of Alpine Lichens collected by him last September in the United States. He gave

an account of the situation and altitude at which they had been gathered; and the Chairman made some remarks on the geographical distribution of each species.

Mr. C. Sherry exhibited a few typical specimens of the useful and beautiful group of plants included in *Scitamineæ*, viz.: *Hedychium Gardnerianum*, representing the Ginger order *(Zingiberaceæ)*; *Canna indica*, representing the Arrowroot order *(Marantaceæ)*; and *Strelitzia reginæ*, representing the Banana order (*Musaceæ*). He described the flower of *Canna indica*, which is of a very peculiar type. The androecium is represented by a number of petaloid staminodes, only one of which—the posterior stamen of the inner whorl—is found with a dimidiate or one-celled anther. One of the staminodes is larger than the others, and is reflexed, forming a labellum. The style is also petaloid, the stigma forming a withered surface at the apex. The fruit is three-celled, and the seeds, which are spherical and very hard, are sometimes used as shot in the East Indies; hence the name, "Indian Shot." *Strelitzia reginæ* is a native of the Cape of Good Hope. The flower-stalk is encircled by the sheath of the leaf-stalk, while its upper portion gives rise to a large bract or spathe, placed obliquely, within which are the flowers. The perianth consists of six segments in two rows: the three outer are ovate-lanceolate, and of a bright orange colour; and the inner are unequal in size, of a bright purple colour, united together, each lobed on the outer side and concealing within a fold five perfect and one sterile stamen. The style is thread-like, and the stigma is divided into three linear branches. This is considered one of the most gorgeous flowers in cultivation.

Mr. Sherry stated that a remarkable Banana, probably the largest in Britain, could now be seen at the Royal Botanic Gardens, Glasgow. It has a soft herbaceous stem 14 feet high, and bears many immense leaves measuring 13 feet × 4 feet. These are traversed by a large midrib of purplish colour, which renders the appearance of the leaves still more remarkable. The plant is a native of Abyssinia, and was recently introduced into this country.

Mr. James Steel exhibited a small collection of exotic Ferns.

Mr. William Craibe Angus exhibited the following Birds obtained in Scotland during last autumn, viz.:

Sabine's Gull, *Gavia Sabini*.—This species, which is new to the Fauna of Scotland, was first discovered on the coast of Greenland in the breeding season by Capt. Sabine, who remarked on the courage with which the bird defended its nest. A specimen found in Ireland was exhibited by Mr. Thomson to the Linnean Society in 1834. Other examples have since then been obtained in Ireland, and according to Yarrell two at least have been captured in England. The specimen under notice

was obtained on Loch Speline, Mull, by Rev. F. W. Champneys, and lent by him for exhibition to the Society. Mr. Angus described the plumage of the bird, which he stated was about the size of the common pigeon, having the head and nape dark, and a darker band or collar round the neck where it joins the white plumage of the body.

Little Gull, *Larus minutus*.—The specimen exhibited was shot by Mr. John Macdonald at North Uist on 1st November last.

Golden Eagle, *Aquila chrysaetos*.—This bird, a male in the dark brown plumage of the second year with the tail white at the base, was found dead, floating lightly on the surface of the water, between Lamlash and Fairlie, in July last. It was without wound of any kind, and had the stomach empty. The finder has since presented it to the Paisley Museum.

A pied immature male Grouse, *Lagopus scoticus*.—With reference to this specimen, Mr. Angus remarked that while most of the albinos previously examined by him had the feathers dull and weak—so weak that the tail and wings were generally worn at the extremities—and some were the victims of old wounds that had healed up, the present example was robust and healthy, with remarkably full and brilliant plumage.

Mr. Thomas King read a Report for 1883 on Experiments with Chilian Seed-Potatoes. *

29TH JANUARY, 1884.

Mr. Peter Cameron, Vice-President, in the Chair.

Mr. William Craibe Angus exhibited a specimen of the Green Woodpecker, *Picus viridis*, on which he made the following remarks:—

In Scotland the Green Woodpecker is of rare occurrence. Pennant, Don, Dr. Fleming, and others include it in their lists; and Yarrell, without quoting any authority, states that it is distributed "over a portion, if not all, the wooded districts of Scotland." This statement has been contradicted by no less an authority than Macgillivray, whose finding has been accepted by subsequent observers.

The latest known occurrences of the species in Scotland were in Aberdeenshire, where one was shot by Mr. William Davidson, gamekeeper, Seaton House, and presented to Dr. Fleming; and in 1868 the late Mr. William Hunter of Tillery, a pupil of Professor Macgillivray, and an observer not likely to have mistaken the species, saw a single bird in the woods near Tillery House.

* *Transactions*, i. 21.

The present example—an immature female—was shot in the early part of the first week of January in North Wales, where the species is permanently resident. It weighed 6½ oz., and the stomach, the contents of which I submitted to Mr. P. Cameron for identification, contained *Myrmica scabrinodes*, a common ant which nests on ground-hillocks but never in trees.

Mr. Thomas Scott, Corresponding Member, exhibited specimens of several varieties of Shells collected in the neighbourhood of Greenock, on which he made the following remarks:—

Helix rotundata, Müll., var. *alba*.—This variety has been found in several places in Scotland, but according to Dr. Jeffreys it is always of rare occurrence. It is similar in form to the type, but its colour is white or greenish.

H. rotundata, Müll., var. *pyramidalis*.—In this variety the spire is more raised than in the type. It has been recorded as occurring in England, but, as far as I am aware, it has not been previously observed in Scotland.

H. arbustorum, L., var. *alpestris*.—Apparently unrecorded for the district.

Pisidium nitidum, Jenyns. Rare in the West of Scotland.

Mr. Scott stated that these Shells had been submitted to Dr. Jeffreys, and verified by him.

Mr. Thomas King exhibited a small collection of Swiss plants, and made some remarks on some of the species which had been observed in Britain.

Mr. Peter Ewing laid on the table a large collection of British Hepaticæ, forming one of the collections which the Museum Committee are preparing for the Kelvingrove Museum.

The following papers were read:—"Notes on *Silene maritima*, L.," by Mr. Thomas Scott, Corresponding Member;* "The Mistletoe," by Mr. R. Turner.†

26th February, 1884.

Mr. Peter Cameron, Vice-President, in the chair.

Messrs. Duncan Mackenzie, 11 James Watt Street, and L. Robertson Sutherland, 18 Ann Street, Hillsborough Square, Hillhead, were elected Ordinary Members.

Mr. R. Turner exhibited specimens of *Tillandsia usneoides*, an epiphyte which grows on oak and pine trees in most of the Southern States of North America, where it is known by the name of "old man's beard." Mr. Turner stated that the plant belongs to the *Bromeliaceæ*, or Pine-apple order, which contains a considerable number of epiphytes; and he described the peculiarities of these plants, which derive their nourishment

* *Transactions*, i. 77. † *Id.* i. 101.

from the air, and not from the branches, on which they merely rest.

Mr. Ernest E. Barker exhibited a gigantic Spider-crab from Japan, measuring 12 feet across between the points of the nippers. Mr. Barker stated that he believed the species to be *Inachus Kempferi*, and he made some remarks on the habits of large marine crustaceans of this class.

Mr. James J. F. X. King exhibited several species of *Neuroptera*, on which he made the following remarks:

Elipsocus cyanops, Rostock, is one of the *Psocidæ* which I captured at Kilmun in June 1880, by beating firs. At that time the species had not been recorded for Scotland. It has been taken at Worcester and Newmarket.

Cœcilius piceus, Kolbe, I obtained at Boxhill, Surrey, during a short visit spent in that favourite entomological hunting-ground in July 1881. The species at that time was undescribed; but it was subsequently described by Kolbe from specimens taken in Saxony.

Mr. King also exhibited an ample series of an interesting variety of *Panorpa germanica*=var. *borealis*, (Leach) Steph., taken during July and August 1883, at Tongue, Sutherlandshire. Alongside the variety was placed a series of the type for comparison. It is to be noticed that the type does not occur at Tongue, so far as can be ascertained. There was also shown a specimen of the var. *apicalis*, Steph., taken at Dalry.

The following papers were read: "Meteorological Notes for 1883, with Remarks on the State of Vegetation in the Public Parks of Glasgow," by Mr. Duncan M'Lellan, Superintendent of Parks;* "Notes on *Tubularia gracilis*," by Mr. W. Anderson Smith; "With the British Association at Southport," by Rev. A. S. Wilson, M.A., B.Sc., Vice-President.

25TH MARCH, 1884.

Dr. James Stirton, F.R.C.S.Ed., F.L.S., President, in the chair.

Mr. David Sharp, M.B., C.M., Eccles, Thornhill, Dumfriesshire, was elected an Honorary Member.

Mr. W. Anderson Smith, Ledaig, Argyllshire, was elected a Corresponding Member.

Mr W. Hunter Bowie, 4 George Street, Edinburgh, was elected an Ordinary Member.

The Constitution of the Society, as revised by a Committee of the Council, was considered, and, on the motion of Mr John Robertson, it was unanimously adopted as follows:

* *Transactions*, i. 80.

CONSTITUTION

OF THE

Natural History Society of Glasgow.

I.

Name of the Society.

The Society shall be called the "Natural History Society of Glasgow."

II.

Objects of the Society.

The objects of the Society shall be to encourage the study of Natural History, to foster a love of the biological sciences, and to stimulate biological research in the West of Scotland. The Society shall seek to promote these objects by—

(1) Meetings for the reading of Papers and exhibition of Specimens.
(2) Excursions for practical work.
(3) The formation of a Library.
(4) The publication of the Society's Proceedings and Transactions.

III.

Members of the Society.

The Society shall consist of Ordinary Members, Corresponding Members, and Honorary Members.

IV.

Ordinary Members.

Every candidate for Membership shall be recommended by at least two Members, to one of whom he must be personally known.

The names of such candidates shall be read by one of the Secretaries at any Meeting at which business can be competently transacted, and shall be printed in the circular calling the ensuing Meeting, at which the vote shall be taken.

Upon election each Ordinary Member shall sign a minute of agreement to the Rules, and shall thereupon receive the Diploma of the Society.

Any such Member, upon written application addressed to the Secretaries, showing a sufficient reason for the consideration of the Council, shall, with its express permission, become entitled to suspend membership, with power to resume its privileges on any subsequent session on payment of the annual subscription then due.

V.

Corresponding Members.

Persons from whom information concerning Natural History may be expected shall be eligible as Corresponding Members on their recommendation by three Members at any Meeting of the Society at which business can be transacted. Their names shall be printed in the circular calling the ensuing Meeting, at which the vote shall be taken.

Corresponding Members shall only be entitled to attend the Meetings and Excursions of the Society. They shall not enjoy any other privileges of membership, unless these be specially granted by the Council; but the Council shall not have power to allow them to vote or hold office.

VI.

Honorary Members.

Eminent Naturalists shall be eligible as Honorary Members. Having been recommended by the Council, their names shall be printed in the circular calling the ensuing Meeting, at which the vote shall be taken.

Honorary Members shall be entitled to the same privileges as Corresponding Members.

VII.

Council—Office-Bearers.

The business of the Society shall be managed by a Council of seventeen, consisting of a President, three Vice-Presidents, nine Councillors, two Secretaries, a Treasurer, and a Librarian, who shall take office for three years. One of the Vice-Presidents and three Councillors shall retire annually by rotation.

Office-Bearers retiring after a full term of three years shall not be eligible for re-election to the same office for one year; but this regulation shall not apply to the Secretaries, Treasurer, or Librarian.

All names of Members intended to be proposed as Office-Bearers shall be sent in writing to the Secretaries at least eight days before the General Meeting in October. They shall then be submitted to the Council, and shall be printed, with the names of the proposers and seconders, in the circular calling the General Meeting.

The Council shall have power to settle all disputes arising from the business of the Society, to enact Bye-laws on points not provided for by the Rules, to fill up vacancies in the Council occurring during the Session, to appoint Committees to take charge of particular departments of the Society's business, and generally to superintend and govern the affairs of the Society.

Five Members of Council shall form a quorum.

VIII.

President and Vice-Presidents.

The President shall be Chairman of all the Meetings of the Society and of the Council at which he may be present; in his absence one of the Vice-Presidents shall take the Chair; and failing them, any Member of Council who may be elected by the Meeting.

IX.

Secretaries.

The Secretaries shall act both for the Society and the Council, shall record the proceedings in the Minute-Book, and shall conduct the correspondence of the Society. All communications relating to the Society shall be laid by them before the Council at the first Meeting after receipt.

X.

Treasurer.

The Treasurer shall collect all subscriptions and moneys due to the Society, and make all payments. In no case shall any payment exceeding £2 be made by him without the approval of the Council having been previously obtained. He shall keep an account of his intromissions in the Cash-Book of the Society, and shall strike a balance at the end of August in each year.

The Balance-Sheet shall be duly audited, and shall be printed in the circular calling the General Meeting.

The Treasurer shall open an account, in his own name and those of two Office-Bearers jointly, with one of the Glasgow Banks, and shall pay into it all funds of the Society, whenever these accumulate in his hands to £2 or upwards.

The Treasurer shall also keep a Register of the names and addresses of Members, which shall be printed in the circular calling the General Meeting.

XI.

Librarian.

The Librarian shall take charge of the Books belonging to the Society, and shall keep a Catalogue of them in a book provided for the purpose.

Books shall be issued on each night of Meeting, and the Librarian shall register the names of the Members who borrow them.

He shall also take charge of the distribution of the Society's printed Proceedings and Transactions. Such sums of money as may be received from their sale he shall pay to the Treasurer.

XII.

Meetings—Ordinary and Special.

The Winter Session of the Society shall extend from September of each year to the following April, and Ordinary Meetings, of which intimation shall be previously given by circular, shall be held on the last Tuesday of each month, at Eight p.m., and at these any competent business of the Society shall be transacted.

The Summer Session shall extend from May to September; and Meetings—for scientific work only, at which no general business of the Society shall be competent—shall be held, and Excursions shall be made, at such times as may be arranged by a Syllabus that shall be issued to the Members at the beginning of such Session.

Other Special Meetings or Excursions may be arranged by the Council, but of these due intimation shall in all cases be given to the Members by circular.

At any Meeting seven Members shall form a quorum.

XIII.

Order of Business.

The Order of Business at the Ordinary Meetings of the Society shall be as follows :

The Minutes of the previous meeting shall be read, amended, if required, and approved of.
Members proposed shall be voted for.
Applications for membership shall be announced.
Miscellaneous business shall be brought up.
Specimens shall be exhibited, with remarks.
Papers and communications shall be read and discussed.

XIV.

Annual General Meeting.

The Annual General Meeting of the Society shall be held on the last Tuesday of October in each year, being the second meeting of the Session.

The Order of Business at this meeting shall be as follows :—

One of the Secretaries shall read the report of the Council on the business of the past year.

The Treasurer shall read a statement of the financial affairs of the Society.

The Librarian shall report on the state of the Library, the circulation of Books, &c.

The Society shall proceed to the election of Office-Bearers, so far as there may be vacancies, and shall also appoint two Members to audit the Accounts.

XV.

Intimations of Meeting, Circulars, &c.

The business of each Meeting of the Winter Session shall be announced by circular issued at least three clear days previously.

These circulars shall not be sent to Corresponding or Honorary Members, unless on written application to the Secretaries.

The circular calling the Annual Meeting shall be sent to every Member on the roll, whether Ordinary, Corresponding, or Honorary.

The Meetings and Excursions of the Summer Session shall be intimated by a Syllabus to be issued not later than the beginning of such Session; and this shall be held to be sufficient intimation, but any further special notice may be given that the Council shall deem requisite.

XVI.

Removal of Members from the Roll.

If a written notice of motion for the removal of the name of any Member from the roll of the Society, and signed by five or more Members, shall be received by the Secretaries, such notice shall be read at the first Ordinary Meeting thereafter, and shall be printed in the circular calling the ensuing Ordinary Meeting. The motion shall at that Meeting be put to the vote, and if supported by three-fourths of the Members present, it shall be declared carried.

This Rule does not apply to the removal from the roll of the names of Members who may be in arrear of their Subscriptions.

XVII.

Voting.

All votes of the Society, when not unanimous, shall be taken by ballot when demanded. Any motion supported by a majority of the Members present (unless when otherwise provided for in the Rules), shall be declared carried.

XVIII.

Subscriptions.

The Entry-Money shall be 7s. 6d., and the Annual Subscription 7s. 6d.

These sums will be due on election, and the Subscription on the 1st September of each year thereafter.

Should a Member be a second year in arrear of his Subscription, the Treasurer shall twice send him notice to that effect, and if payment be not made his name shall be removed from the roll.

At the January Meeting of each year, and thereafter during the Session, the Treasurer shall place in the Society's Rooms a list of Members having all arrears of Subscriptions entered therein.

Should the sum in the Treasurer's hands be insufficient to meet the current expenses of the Society, the Ordinary Members shall be liable to make up the deficit in equal proportions, and it shall be competent for the Treasurer to levy and collect such sums.

Members shall be liable for their Subscriptions up to the date at which they shall give written notice to the Secretary of their resignation or suspension (Rule IV.).

Members whose Subscriptions are in arrear shall not be entitled to hold office, to vote, to use the Library, or to receive the printed Proceedings and Transactions of the Society.

Life Membership may be compounded for by a single payment of £5 5s.

XIX.

Proceedings and Transactions of the Society.

The Proceedings and Transactions of the Society shall be printed and issued as soon as practicable after the close of each Session. They shall be edited by a Publishing Committee, to be elected annually by the Council; and this Committee shall decide as to the Papers or Abstracts of Papers that shall be printed, and the extent to which they shall be illustrated.

Ordinary Members shall be entitled to receive, free of charge, one copy of each part of the Society's Proceedings and Transactions issued for the year of their membership; but should sufficient funds not be available for the purpose, the Council shall have power to fix a charge for each Part, not exceeding the cost price thereof. Duplicate and back Parts shall in all cases be charged for.

The publications shall be on sale to Members at 25 per cent. below published prices.

Authors of Papers shall be entitled to receive 25 copies of their Papers free. Extra copies shall be charged cost price.

XX.

Motions affecting the Constitution.

Notices of Motions affecting the Constitution of the Society shall be read at an Ordinary Meeting, and shall be printed in

the circular calling the ensuing Meeting, at which they shall be brought up for discussion. If supported by two-thirds of the Members voting they shall be declared carried.

XXI.

The Library.

The Council shall have power to add to the Library suitable books. A motion made and seconded at an Ordinary Meeting for the addition of any book to the Library shall be remitted to the Council, whose decision shall be final. The Council shall have power to reject books presented to the Library if they are found unsuitable.

No volume shall be retained by a Member for a longer period than one month; but the loan may be renewed for a similar term if no other application has been made for the work. No Member shall be entitled to borrow more than two volumes at one time without special permission from the Council.

XXII.

Donations to the Society.

Any donation to the Society, except Money, Books, and MSS., may, if approved by the Council, be presented to one of the local museums. In the event of the Society deciding to form a collection in any special branches of Natural History, suitable donations will of course be retained for that purpose. All donations accepted shall be acknowledged in the Society's circular.

Mr. William Craibe Angus exhibited an adult example of the Common Bittern, *Botaurus stellaris*, shot near Leeds, Yorkshire, and kindly lent for exhibition by Mr. Macdougall. The plumage was of rare beauty, being full and complete. In the stomach of the bird were found the remains of a water-rat.

A paper was read by Mr. David Robertson, F.L.S., F.G.S., on "The Habits of the Common Limpet." *

29th April, 1881.

Mr. Peter Cameron, Vice-President, in the Chair.

Messrs. Robert M'Lachlan, F.R.S., F.L.S., West View, Clarendon Road, Lewisham, London, S.E., and James Ramsay, 159 Eglinton Street, Glasgow, were elected Honorary Members.

* *Transactions*, i. 9.

Mr. Robert Walker, Institute of the Fine Arts, 175 Sauchiehall Street, was elected an Ordinary Member.

The Chairman (Mr. Cameron) exhibited a new species of *Eucerus*, taken at Pitlochry last summer, and made some remarks on the habits and characteristics of the genus.

Mr. D. Gregorson exhibited a collection of marine *Algæ*, on which he made some descriptive remarks.

The following papers were read: "The Top-Knots," by Mr. W. Anderson Smith, Corresponding Member;* "The Fauna of Scotland: *Hymenoptera*, part ii.," by Mr. Peter Cameron, Vice-President; "A few Notes on the Mammals and Birds of Rousay, one of the Orkney Islands," by Mr. T. E. Buckley, B.A., F.Z.S.†

* *Transactions*, i. 88. † *Id.* i. 44.

ABSTRACT STATEMENT OF ACCOUNTS.—Session 1882-83.

To Cash in Treasurer's hands, ...	£2	10	1	By Rent and Attendance, ...	£13	1	0
,, 192 Members' Annual Subscriptions at 5s.,	48	0	0	,, Postages, Carriages, &c., ...	15	13	11
,, 30 New Members' Entry-money at 10s.,	15	0	0	,, *Proceedings*, ...	59	3	7
,, 17 Members' Arrears, ...	5	10	0	,, Diplomas, ...	3	0	0
,, *Proceedings*, &c., sold, ...	5	15	4	,, Magazines and Books, ...	1	0	4
,, Subscriptions received for Library Fund,	1	12	6	,, Fittings, &c., in Rooms, ...	0	10	0
,, Balance due Treasurer, ...	14	0	11				
	£92	8	10		£92	8	10

Note.—Life Members' Subscriptions are in Savings Bank, and amount to £52.

September 24th, 1883.—Compared with Vouchers and found correct.

(Signed) ARCHIBALD ROBERTSON.
A. MALLOCH BAYNE.

SUMMER SESSION, 1884.

20TH MAY, 1884.

Mr. Peter Cameron, Vice-President, in the Chair.

Mr. D. A. Boyd reported on an excursion made to Neilston on the 17th inst. Among the plants collected was an abnormal flowering-scape of *Tussilago Farfara*, L., having, in addition to the usual terminal head of flowers, two smaller scapes springing from the axils of the scales, both bearing a small head of flowers.

Mr. Thomas King exhibited a teratological specimen of a rose, with the whole of the petals, &c., transformed into green phylloid expansions, affording a striking example of phyllody of the petals.

The remainder of the evening was devoted to the exhibition of microscopic objects. Among these were sections of hymenopterous leaf-galls, prepared by the Chairman, illustrating the modifications produced in growing vegetable tissues through the action of insects. Mr. Richard M'Kay showed a series of slides, illustrating the seeds of British plants. Many of these—especially the seeds of the *Caryophyllaceæ* and *Scrophulariaceæ*—possessed remarkable beauty in the symmetry of their outlines and delicate details of their markings.

3RD JUNE, 1884.

Mr. Henry E. Clark, M.R.C.S., Vice-President, in the Chair.

Mr. D. A. Boyd reported on an excursion made to Devol's Glen, Port-Glasgow, on 31st ulto. Among the plants collected were *Viburnum Lantana*, L., *Aspidium aculeatum*, Sw., *Asplenium viride*, Huds., *Gymnostomum rupestre*, Schw, *Bartramia pomiformis*, L., type and var. *crispa*, *B. ithyphylla*, Brid., *Pterygophyllum lucens*, L. (in fruit), and *Neckera crispa*.

Mr. James J. F. X. King exhibited specimens of *Hydroptila femoralis*, Eaton, captured near Port-Glasgow on the same date; and he stated that the species is new to the Scottish Fauna, having hitherto been recorded for Derbyshire only.

Mr. King also exhibited two cases of Insects collected at Frankfort-on-the-Oder by Mr. Lucas, and subsequently in the possession of the late Dr. John Dougan, Glasgow.

Mr. Peter Cameron, Vice-President, exhibited a specimen of *Carabus nitens*, L., from Glen Messen, near Dunoon; and Mr. George R. Alexander, a collection of Mosses.

Mr. Thomas King made some remarks on the use of the magic-lantern for purposes of teaching, and expressed the opinion that for general teaching the lantern possessed the advantage over the microscope of lessening both labour and expense. By means of micro-photography the magnified image of minute objects, such as sections of vegetable tissues, diatoms, &c., could be photographed in a form available for use as a lantern-slide. With the aid of such slides the teacher could at once explain to the whole class what could only with the microscope be explained individually. In illustration of his remarks, Mr. King exhibited a series of lantern-slides representing groups of the *Diatomaceæ*, sections of tissues, &c., and in every case the minute details of the objects shown were brought out with a very clear definition.

17th June, 1884.

Mr. M. C. Duff in the Chair.

Mr. James Steel reported on an excursion made to Ailsa Craig on 5th inst., by invitation of the Kilmarnock Philosophical Society. The island affords a habitation to immense flocks of sea-birds, of which many species breed on the precipitous rocks and grassy ledges. Several Puffins were captured; and among the numerous eggs found were those of the Black-headed Gull, Guillemot, and Razorbill. The only reptile observed was the Blind-worm, *Anguis fragilis*, L. Land and marine shells seemed plentiful enough; but as the time for collecting was necessarily limited, comparatively few species could be obtained. *Trochus cinerarius*, L., seemed to be the most abundant of the marine shells, while *Littorina littorea*, L., was somewhat scarce. Many of the shells presented peculiarities in form and marking, due, no doubt, to local influences, such as exposure and feeding. *Littorina littorea*, for example, was of unusual size and beauty, having the lip pure white round the greater part of the whorl. Several plants were collected, including *Asplenium marinum*, L., which formed a graceful ornament to the bare and exposed rocks where it was found growing.

Mr. James Barrie Low, M.A., reported on an excursion made to Cleghorn on 12th inst. Along the valley of the Mouse, be-

tween Cleghorn Mill and Cartland Crags, many rare and interesting plants were observed, including the following species:

Ranunculus auricomus, L.
Trollius europæus, L.
Arabis hirsuta, Br.
Helianthemum vulgare, Gærtn.
Tilia grandifolia, Ehr.
Geranium lucidum, L.
G. sylvaticum, L.
Vicia Orobus, DC.
V. sylvatica, L.
Lathyrus macrorrhizus, Wimm.
Geum intermedium, Ehr.
Rubus saxatilis, L.
Chrysosplenium alternifolium, L.
Carum Carui, L.
Viburnum Opulus, L
Galium boreale, L.
Carduus heterophyllus, L.
Crepis paludosa, Mœnch.
Hieracium murorum, L.
Campanula latifolia, L.
Pyrola minor, Sw.
Vinca minor, L.
Melampyrum pratense, L.
Calamintha Clinopodium, Benth.
Polygonum Bistorta, L.
Orchis mascula, L.
Epipactis latifolia, Sw.
Listera ovata, L.
Neottia Nidus-avis, L.
Triglochin palustre, L.
Convallaria majalis, L.
Milium effusum, L.
Melica uniflora, Retz.
M. nutans, L.
Briza media, L.
Asplenium Trichomanes, L.
Cystopteris fragilis, Bernh.
Aspidium aculeatum, Sw. var. *lobatum*, Sw.
Equisetum hyemale, L.
Gymnostomum rupestre, Schw.—fruit.
Barbula ruralis, Hedw.—fruit.
Anomodon viticulosus, L
Encalypta streptocarpa, Hedw.
Neckera crispa, L.
Hypnum filicinum, L.—fruit.
Hylocomium triquetrum, L.—fruit.
Dædalea quercina, P.

Mr. Thomas Scott, Corresponding Member, exhibited specimens of *Galium boreale*, L., and *Neottia Nidus-avis*, L., from the neighbourhood of Greenock.

Mr. John Kirsop, F.S.A.Scot., sent for exhibition a number of Foreign Shells, including some very interesting species.

Mr. Ernest E. Barker made some remarks on Shells and their modes of growth, which he illustrated with numerous beautiful specimens of foreign species.

1st July, 1884.

Mr. George R. Alexander in the Chair.

Mr. John Broom reported on an excursion made to Manuel on 28th ulto., and enumerated the rarer plants observed. One of the largest of the fine group of yew-trees at Manuel Mill was measured, and found to be 12 ft. 8 in. in circumference at a height of 4½ feet from the ground. A garden of the old Scotch type was also visited, where many showy flowers, formerly garden favourites, are still to be seen in cultivation.

Mr. Thomas King exhibited specimens of the following plants from Innellan, viz.: *Geranium lucidum*, L., *Lactuca muralis*, Fresen., *Habenaria bifolia*, Br., *H. chlorantha*, Bab., and *Equisetum Telmateia*, Ehr.

Mr. Robert Turner exhibited a fine specimen of *Orobanche major*, L., from the neighbourhood of Dumfries, and remarked that the plant, which is parasitic on the roots of the shrubby *Papilionaceæ*, is rare in Scotland, where it is confined to the extreme south-western counties.

An exhibition of microscopic objects afterwards took place.

29TH JULY, 1884.

Mr. R. Turner in the Chair.

Dr. James Stirton, F.L.S., President, exhibited a fine specimen of *Saxifraga rivularis*, L., gathered on Ben Lawers by Rev. John Pagan, M.A., Bothwell.

Mr. Peter Ewing gave an account of botanical excursions to Ben Lawers and Creag-an-Lochan, between 18th and 22nd inst., and submitted the following list of the rarer flowering-plants seen on these mountains, viz.:—

Thalictrum alpinum, L.—Common.
Caltha palustris, L., var. *minor*, Syme.—Frequent.
Trollius europæus, L.—Frequent.
Arabis petræa, Lamk.—Frequent.
Cochlearia alpina, Wats.—Common.
Draba inflata, Wats.—About 15 plants.
D. incana, L.—Frequent.
D. rupestris, Br.—Seems to be getting scarce.
Cerastium alpinum, L., vars. *lanatum* and *pubescens*. Common.
Cherleria sedoides, L.—Common.
Alsine rubella, Hook.—Frequent.
Sagina saxatilis, Wimm.—Common.
S. nivalis, Fries.—A good many plants, but small.
Sibbaldia procumbens, Clairv.—Common.
Potentilla alpestris, Hall. f.—Frequent.
Dryas octopetala, L.—Creag-an-Lochan.
Epilobium alsinifolium, Villars.—Common.
E. anagallidifolium, Lamk.—Common.
E. alpinum, L.—Frequent.
Saxifraga nivalis, L.—Common.
S. oppositifolia, L.—Common.
S. rivularis, L.—Rare, Ben Lawers.—*Dr. Stirton.*
S. cernua, L.—Ben Lawers. In poor condition; seems to be getting rooted out.

Cornus suecica, L.—Frequent, Ben Lawers.
Saussurea alpina, L.—Frequent.
Erigeron alpinum, L.—Frequent, Ben Lawers.
Solidago cambrica, Huds.—Frequent.
Loiseleuria procumbens, Desv.—Frequent.
Pyrola rotundifolia, L.—Rare.
P. secunda, L.—Rare.
Gentiana nivalis, L.—Locally frequent.
Veronica humifusa, Dicks.—Common.
V. saxatilis, L.—Frequent; rare round Lochan-a-Chait.
Melampyrum montanum, Johnst.—Common.
Myosotis alpestris, Schmidt.—Common, Ben Lawers.
Salix nigricans, Sm., var. *Andersoniana*, Sm.—Frequent.
S. repens, L.—Frequent.
S. Lapponum, L.—Frequent.
S. Arbuscula, L., vars. *prunifolia*, Sm., *venulosa*, Sm., and *vacciniifolia*, Walker.—Frequent.
S. herbacea, L.—Common.
S. reticulata, L.—Common.
Potamogeton Kirkii, Syme.—Common.
Tofieldia palustris, Huds.—Common.
Luzula spicata, DC.—Common.
Juncus trifidus, L.—Common.
J. castaneus, L.—Locally frequent.
J. triglumis, L.—Common.
J. biglumis, L.—Frequent.
Carex atrata, L.—Common.
C. rigida, Good.—Common.
C. vaginata, Tausch.—A few plants.
C. capillaris, L.—Common.
C. pulla, Good.—Common.
Phleum alpinum, L.—Rare.
Sesleria cærulea, Scop.—Frequent.
Aira cæspitosa, L., vars. *brevifolia* and *pseudo-alpina*.—Frequent.
A. alpina, L.—Frequent.
A. montana, L.—Common.
Avena alpina, Sm.—Common.
Poa alpina, L.—Common.
P. glauca, Sm.—Common.
Asplenium viride, Huds.—Common.
Woodsia hyperborea, Br.—Local.
Cystopteris montana, Link.—Local.
Aspidium Lonchitis, Sw.—Common.
Polypodium alpestre, Hoppe.—Common.
Equisetum variegatum, Schleich.—Common.

Dr. Stirton reported that along with several members of the Society, and the Rev. John Pagan, M.A., Bothwell, he had

visited Ben Lawers on 19th inst. Among the rarer plants noticed on the western side of the mountain were *Alsine rubella* (frequent), *Erigeron alpinum* (of which a few plants were seen), *Veronica saxatilis* (plentiful), *V. humifusa* (frequent), and *Gentiana nivalis* (of which several plants were observed). Many rare mosses and lichens were also collected.

Mr. James J. F. X. King reported that when recently visiting Mull he had found *Dytiscus lapponicus* in plenty in the recorded station for the insect in that island.

Mr. Richard M'Kay reported on an excursion made to Innellan on 26th inst. Among the plants collected were *Lactuca muralis*, L., and *Veronica Buxbaumii*, Pen., the latter evidently an alien, although growing as a weed in many of the gardens in the Innellan district.

Mr. Joseph Sommerville exhibited fine specimens of an unusually large species of Dry-rot fungus, in its spore-bearing condition; and in the course of some remarks he stated that the species, which differed considerably from the common *Merulius lacrimans*, was obtained from imported foreign timber. He also showed a small piece of the timber of *Sequoia gigantea*, and stated that the wood is now being extensively imported for building purposes, for which it is well adapted. The tree is remarkable for its immense size, one of the planks recently cut having measured 13 feet in breadth.

Mr. D. A. Boyd exhibited specimens of *Alchemilla vulgaris*, L., var. *montana*, Willd., and *Melampyrum sylvaticum*, L., from the neighbourhood of Aberfeldy, and made some remarks on the characteristics of these plants.

12TH AUGUST, 1884.

Mr. Peter Cameron, Vice-President, in the Chair.

Mr. Loudon M. Douglas exhibited a jaw-bone with the teeth in a good state of preservation, and stated that the bone had been found in a consignment of guano recently received from South America. Such animal remains are of frequent occurrence among the guano deposits; and, judging from their appearance, many of them have remained buried for a long period, their protection from the air having preserved them from decay.

Mr. D. A. Boyd stated that when recently visiting Port Sonachan, Loch Awe, he had observed many very luxuriant patches of *Silene maritima*, L., growing on the shore of the Loch. Although pre-eminently a maritime plant, isolated specimens are occasionally found high up on the mountains, along with *Armeria maritima*, &c., but seldom at a low elevation at

so great distance from the sea-shore. Mr. Boyd suggested that the presence of so much of the plant in this situation might be due to the Loch having been at one time an arm of the sea.

26TH AUGUST, 1884.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. James Steel reported on a dredging excursion made on 16th inst., under the leadership of Mr. Frank Coulson, who kindly granted the use of his steam-yacht, which is fitted with the most perfect appliances for dredging. The ground selected was Rothesay Bay; but unfortunately the day was wet and rather stormy, and the party had therefore to limit considerably the range of their investigations. The results, however, were satisfactory,—crustacea, mollusca, star-fish, and various forms of protozoa, being obtained in abundance. The principal find was a beautiful specimen of *Defrancia gracilis*, Mont., about an inch in length.

Mr. Steel exhibited many of the objects which had been dredged, and made remarks on such of them as were worthy of special notice.

Mr. D. A. Boyd reported on an excursion made to Fairlie on 23rd inst. The shore between Fairlie and Hunterston afforded a rich botanical field; and among the plants observed were the following species, viz. :—

Ranunculus sceleratus, L.
Spergularia neglecta, Syme.
S. marginata, Syme.
Erodium cicutarium, L.
Anthyllis Vulneraria, L.
Eryngium maritimum, L.
Œnanthe crocata, L.
Carduus crispus, L.
Filago minima, Fries.
Lycopsis arvensis, Bieb.
Solanum Dulcamara, L.
Scutellaria galericulata, L.
Samolus Valerandi, L.
Salicornia herbacea, L.
Suæda maritima, Dumort.
Zostera marina, L.
Z. nana, Roth.
Juncus maritimus, L.
J. Gerardi, Loisel.
J. compressus, Jacq.
Scirpus maritimus, L.
S. Savii, Schultes.
Blysmus compressus, Panz.
B. rufus, Link.
Carex vulpina, L.
C. extensa, Good.
C. fulva, Good.
C. paludosa, Good.
Catabrosa aquatica, Beauv., var. *littoralis*, Parn.
Sclerochloa maritima, Wahl.
Triticum junceum, L.
Lepturus filiformis, Trin.
Barbula ruralis, Hedw.
Fucus ceranoides, L.
F. vesiculosus, L.
F. serratus, L.
F. canaliculatus, L.
Enteromorpha intestinalis, L.
E. compressa, L.
E. clathrata.
Cladophora rupestris, L.
Chaetomorpha, sp., probably *linum*.
Halidrys siliquosa, Lyn.

Mr. D. Gregorson, F.E.I.S., exhibited specimens of the *Algæ* collected, and made some remarks on the characteristics of each species.

Mr. James Steel exhibited a species of *Cyclostoma*, recently received by him, along with other shells, from Mr. John Farquhar, Port Elizabeth, South Africa, a former member of the Society. Mr. Steel stated that on examining the shell the animal appeared to be still alive; and when immersed in tepid water it revived and crawled about, apparently little the worse for its long imprisonment.

Mr. Steel also made some remarks on the viviparous reproduction of *Sphærium corneum*, L. On 20th April last, when watching the siphons of several of these molluscs embedded in sand at the bottom of his aquarium, he observed that one of the largest was producing movements of an unusual character. These could not proceed from fear, as the animal, when alarmed, withdraws its siphons entirely within the shell. After a number of expansions, contractions, and swayings to and fro, of the siphons, which had now assumed a yellowish colour, the true cause of the movement became apparent—a small shell being suddenly shot out from the shorter or ejecting siphon. Mr. Steel stated that while this species is well known to be ovo-viviparous, he had never seen the actual manner described in which its young are launched into active life.

The Chairman exhibited a fine specimen of *Hypnum Halleri*, L. fil., gathered by him on Ben Lawers on 13th inst.; also, for comparison, a fertile plant of the same species from the Swiss Alps. He also showed specimens of the following Lichens, on which he made some remarks, viz.: *Spilonema paradoxii*, *Cladonia pungens*, *Ramalina farinacea*, *Lecanora ventosa*, and *Opegrapha atra*, var. *denigrata*.

9TH SEPTEMBER, 1884.

Mr. Peter Cameron, Vice-President, in the Chair.

Mr. Thomas King gave an interesting account of the meetings and excursions of the Cryptogamic Society of Scotland, held at Kelso on 3rd, 4th, and 5th inst. He also exhibited several species of Fungi from the Kelso district, including *Agaricus maculatus*, *A. flammans*, *Polyporus abietinus*, and *Xylaria polymorpha;* also the following species from Craigton Woods, near Milngavie, viz.: *Cortinarius sanguineus*, *Boletus piperatus*, B. *edulis*, and *Polyporus intybaceus* (rare in the district).

Mr. Peter Ewing exhibited specimens of *Lepidium latifolium*, L., and *Dipsacus sylvestris*, L., from the Fifeshire coast near Kirkcaldy.

An exhibition of microscopic objects afterwards took place.

WINTER SESSION, 1884-85.

30th September, 1884.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. John P. M'Ewen, 157 West George Street, was elected an Ordinary Member.

Mr. Thomas Scott, Corresponding Member, exhibited specimens of the four species of Skua found in Britain, viz.: Richardson's Skua, *Stercorarius crepidatus*, Gmel.; Pomatorhine Skua, *S. pomatorhinus*, Temm.; Common or Great Skua, *S. cataractes*, L.; and Buffon's Skua, *S. parasiticus*, L. Mr. Scott stated that these birds, which had been kindly lent for exhibition by the Directors of the Greenock Museum, were all obtained on the west coast of Scotland, and he made some remarks on their characteristic features.

Mr. W. R. Baxter exhibited a fine series of the eggs of British Terns, collected by him in the Benderloch district and elsewhere.

Mr. Thomas King exhibited specimens of *Crucibulum vulgare*, from Kent, which he had received from Dr. Flaxman Spurrell; and he described fully the peculiar development and fructification of this fungus.

Mr. King also reported on an excursion made to Cadzow Forest, Hamilton, on 27th inst., and exhibited specimens of the rarer and more interesting Fungi which had been obtained. These included the following species:

Agaricus infundibuliformis, var. *membranaceus*.

Polyporus dryadeus.—Three specimens observed growing at the roots of the old oak-trees. A single example was seen last autumn in the woods at Barncluith, but the species is rare in the district.

P. sulfureus.—Also found on the oaks in very fine condition, growing in large imbricated masses.

Fistulina hepatica.—Plentiful this season on the oaks, but found only sparingly last year.

Bulgaria inquinans.—Common on the trunks of fallen trees.

Mr. King also exhibited specimens of *Polyporus betulinus*, from Milngavie, and *Agaricus platyphyllus* (rare in the district), found in Cadder Wilderness on 15th inst.

The Chairman made some remarks on his second visit this season to Ben Lawers, on 13th inst., along with Mr. George Horn, a member of the Society. He also exhibited specimens of *Grimmia atrata*, Miel., a rare alpine moss, and pointed out

the characters by which it may be distinguished from *Racomitrium ellipticum*, Turn., an allied species, to which it bears a considerable resemblance.

Dr. Stirton also showed specimens of several rare Lichens, on which he made some remarks.

Mr. D. Corse Glen, C.E., F.G.S., the Society's delegate at the meetings of the British and American Associations, gave an account of his visit to Canada and the United States, and described many of the places of interest through which he had passed.

THE THIRTY-THIRD ANNUAL GENERAL MEETING.

28TH OCTOBER, 1884.

Mr. Peter Cameron, Vice-President, in the Chair.

The Treasurer, Mr. M. C. Duff, submitted his Annual Financial Statement, which showed a balance due to him of £5 13s. 7d. This, however, did not include the Life-Members' subscriptions, which were kept in a separate account, and amounted, with interest, to £54 0s. 9d.—the actual balance at the credit of the Society being £48 7s. 2d.

The Secretary read the Report of the Council on the business of last Session.

REPORT OF THE COUNCIL.

The Council have to report that since last Annual General Meeting the number of new members added to the Roll of the Society has been 31, being 1 less than in the previous year. After careful revision, the Roll at present contains the names of 12 Honorary, 28 Corresponding, and 244 Ordinary Members, giving a total Membership of 284.

The obituary record contains the name of Mr. John Eaton Reid, a Life-Member, whose connection with the Society extended over a period of 26 years.

The usual number of meetings were held during the Session, and were well attended, the papers read and specimens exhibited covering a wide field of biological research. Reports of the meetings were regularly sent to the Glasgow newspapers, so that the work done by the Society might be kept prominently before the public. A slip, containing particulars of the Society and its work, has also been placed, by permission, in the covers of the scientific periodicals in the Mitchell and Stirling's Libraries; and this, it is hoped, may be the means of inducing isolated workers to avail themselves of the greater advantages afforded by the Society for pursuing the study of Natural History.

A large collection of British *Hepaticæ*, prepared by the Museum Committee, and containing about 80 specimens, has been handed over to the Parks and Galleries Committee of the Town Council of Glasgow to be placed in the Kelvingrove Museum; and the Council trust that the members of the Society will continue to assist the Museum Committee in a work of so much importance to scientific students, as the providing of such collections must obviously be.

To meet the views expressed by a large portion of the members, a revised Constitution was prepared by a Committee of the Council and adopted by the Society at a meeting held on 25th March; and the Council trust that under the new rules the work of the Society will be found to proceed harmoniously.

The publication of vol. v., part iii., of the *Proceedings* has been considerably delayed through unexpected difficulties experienced by the Publishing Committee in carrying out their work; but it is believed that this part will be ready to be issued to the members at an early meeting. The Council desire to express their thanks to those members who have rendered assistance to the Committee by supplying fresh MSS., and otherwise aided in the completion of the work.

The part of the *Proceedings and Transactions* for 1883-84 is also in the press, and is expected to be ready for distribution in the course of the present Session.

In consequence of the changes arising in the number and work of the Office-Bearers through the operation of the revised Constitution, the Council have resolved to vacate their respective offices at this meeting, offering themselves for re-election.

In conclusion, the Council beg to express the hope that during the present Session the members will endeavour to extend the work of the Society, and promote the success of its efforts for the advancement of scientific knowledge.

Mr. James J. F. X. King, Librarian, reported as follows: The books are in good condition, and have been much taken advantage of during the past Session, 189 volumes having been issued (of which 71 were given out during the Summer), as compared with 179 during Session 1882-83.

460 separate publications, contributed by 92 different Societies, Magazines, &c., have been added in the past year, besides 29 odd works received from authors, &c.

In response to an appeal, the Commissioners of many of the Departments at the "International Fisheries Exhibition" presented the Society with a large number of Pamphlets, bearing on Fisheries, &c., published under the auspices of their various Governments.

The new Library Catalogue has had a fair sale, upwards of 100 copies having been disposed of.

The Society's *Proceedings*, vol. v., part ii., has been sent to 115 Societies, Institutions, Magazines, &c.

The Library now contains 598 bound volumes, besides a large amount of unbound material; and the Librarian would recommend that a portion of the latter, including such volumes as have been completed, should be placed in the hands of the binder immediately, as many of the works—*Transactions* of Foreign Societies—contain valuable monographs which are not to be obtained in any other Library in Glasgow. These, when unbound, and especially when containing plates, are very liable to injury if kept in a loose condition.

On account of the accessions to the Library during the year, the additional accommodation, which was provided last Session, has been fully occupied; and it has been found necessary to ask that some further book-cases be obtained for the conservation of the valuable works of Foreign Societies which are rapidly accumulating, and for the proper arrangement of which no space is at present available.

The Chairman, as Convener of the Museum Committee, reported on the work done by the Committee during the past year. In addition to the collection of *Hepaticæ*, which has been completed and handed over to the Curator of the Kelvingrove Museum, several other collections are in course of preparation.

Mr. James Steel, Summer Secretary, reported on the work of the Summer Session. The usual number of meetings and excursions had been held, at which the average attendance was good.

The reports were all unanimously adopted.

The following Office-Bearers were then elected: President, James Stirton, M.D., F.R.C.S.Ed., F.L.S.; Vice-Presidents, Peter Cameron, Henry E. Clark, M.R.C.S., and Robert Turner; Secretaries, D. A. Boyd and William Goodwin; Treasurer, M. C. Duff; Librarian, James J. F. X. King; Members of Council, James Dairon, F.G.S., James Steel, Peter Ewing, David Gregorson, F.E.I.S., D. Corse Glen, C.E., F.G.S., Freeland Fergus, M.B., Thomas King, John Kirsop, F.S.A.Scot., and Richard M'Kay.

Messrs. Archibald Robertson and George M'Kinlay were appointed Auditors for the ensuing year.

The following were elected Ordinary Members, viz.: Messrs. Charles William White, 2 Woodrow Circus, Pollokshields; Alexander Skirving, I.A., 121 West Regent Street; Fred. W.

Robertson, Dunard, Dowanhill; John Pye, 31 Renfield Street; Matthew Ballantine, 16 Glassford Street; George Watson, 175 West George Street; J. T. Moore, M.D., 151 Bath Street; and John Orr, 10 Newhall Terrace.

25th November, 1884.

Mr. Henry E. Clark, M.R.C.S., Vice-President, in the Chair.

The following were elected Ordinary Members, viz.: Messrs. James Robertson, 48 West Nile Street; Crawford B. Lucas, 13 Hamilton Drive, Hillhead; and David N. Knox, M.A., M.B., F.F.P.S.G., 8 India Street.

The Chairman exhibited a collection of Human Skulls, many of which were from the Museum of the late Dr. William M'Kenzie, the celebrated oculist. The collection included Negro, Esquimaux, Malay, North American Indian, Hindoo, and South African skulls. One of the Indian skulls showed marked evidences of old-standing syphilitic ostitis, a condition seldom found in the uncivilised races, and fortunately getting less frequent in this country. The South African skulls were those of a Basuto and a Karana,—the latter was executed for murder about three years before the skull was disinterred. Mr. Clark made some interesting remarks on the illustration which these examples afforded of the variation in the shape and capacity of the skull among the various races of mankind.

Mr. T. J. Henderson exhibited some rock and heather-frequenting *Lepidoptera*, and in the course of some remarks he drew attention to the resemblance which the markings of the insects bore to the colour of the rock and heather which they frequented. In some instances this resemblance was so striking that when the moths were at rest they could only with difficulty be distinguished from their surroundings, and were thus afforded a means of protection from their numerous enemies which was not possessed by more gaudily-coloured species.

Rev. John Muir exhibited a teratological specimen, gathered near Ayr, of the common Buttercup *(Ranunculus)*, which afforded a striking example of stem-fasciation.

Mr. Peter Ewing exhibited a specimen of *Ranunculus reptans*, L., from Loch Leven, Kinross-shire, and stated that he had for some time, when visiting that district, been engaged in observing the growth of this plant. The result of his observations had led him to regard the plant as merely a form of *R. Flammula*, L., due to the situation in which it had grown; and he believed that in moist, sandy spots, such as the shores of Loch Leven, where the plants are covered with water for the greater part of the year, it would be found that *R. Flammula* showed a tendency to pass into the form known as

R. reptans. In support of this view, Mr. Ewing exhibited, for comparison with the Loch Leven plant, a specimen from Loch Tay, and a series of specimens from the bed of a mill-dam whence a stream runs into Loch Leven about six miles from the spot where the specimen of *R. reptans* first exhibited was gathered. These all showed a gradation of form from the typical *R. Flammula* to *R. reptans*.

The following papers were read, viz.: "Notes on some of the Plants of the Clyde district," by Mr. D. A. Boyd;* "The Medlar, Apple, and Quince: Remarks on the Structure of their Fruit," by Mr. Thomas King.†

30TH DECEMBER, 1884.

Mr. Robert Turner, Vice-President, in the Chair.

The Chairman referred to the loss which the Society had sustained, since last meeting, in the death of Mr. James Napier, F.C.S., F.R.S.E., Maryfield, Bothwell, one of the oldest members.

Messrs. John Shaw, South Park, Mount Vernon, and Alexander Stewart, 164 Bath Street, were elected Ordinary Members.

Mr. Thomas Scott, Corresponding Member, exhibited specimens of *Cytheropteron humile*, Brady, an addition to the known species of marine *Ostracoda*. In the course of some remarks on the shells in this genus, Mr. Scott drew attention to their peculiar shape, from which the generic name is derived. He stated that the specimens under notice had been dredged by him from the Clyde between Fort Matilda and Greenock in July last, and afterwards sent to Dr. George S. Brady, F.L.S., Sunderland, who pronounced them to be new to science. The species has since been described by Dr. Brady, and will be included in the revised Monograph of the British *Ostracoda* upon which he and several other eminent naturalists are at present engaged.

Mr. Scott also exhibited specimens of *Pagurus lævis*, Thompson, *P. Thompsoni*, Bell, *Ophiocoma filiformis*, and *O. neglecta*, all dredged by him from the Clyde between Toward and Rothesay on 9th August last.

Mr. Peter Ewing exhibited a collection of mounted specimens of the rarer Scottish Alpine plants, including the following species, viz.: *Draba inflata*, Hook.; *D. rupestris*, Brown; *Lychnis alpina*, L.; *Cerastium alpinum*, L., vars. *lanatum* and *pubescens*; *Cherleria sedoides*, L.; *Alsine rubella*, Wahl.; *Sagina saxatilis*, Wimm.; *S. nivalis*, Fries; *Saxifraga rivularis*, L.;

* *Transactions*, i. 151. † *Id.*, i. 134.

S. cernua, L.; *S. sponhemica*, Gmel.; *Gnaphalium norvegicum*, Gunn; *Erigeron alpinum*, L.; *Hieracium melanocephalum*, Tausch; *H. holosericeum*, Backh.; *H. eximium*, Backh., type, and var. *tenellum*; *H. gracilentum*, Backh.; *H. nigrescens*, Willd.; *H. chrysanthum*, Backh., type, and var. *microcephalum*; *H. iricum*, Fries; *H. lasiophyllum*, Koch; *H. argenteum*, Fries; *H. nitidum*, Backh.; *H. obtusifolium*, Backh.; *Pyrola rotundifolia*, L.; *P. secunda*, L.; *Gentiana nivalis*, L.; *Veronica alpina*, L.; *V. saxatilis*, L.; *Bartsia alpina*, L.; *Myosotis alpestris*, Schmidt; *Salix lanata*, L.; *S. arenaria*, Sm.; *S. prunifolia*, Sm.; *S. venulosa*, Sm.; *S. vacciniifolia*, Walker; *S. reticulata*, L.; *Juncus castaneus*, Sm.; *J. biglumis*, L.; *Kobresia caricina*, Willd.; *Carex alpicola*, Wahl.; *C. atrata*, L.; *C. Watsoni*, Bosw.; *C. vaginata*, Tausch; *Alopecurus alpinus*, L.; *Phleum alpinum*, L.; *Sesleria cærulea*, Scop.; *Aira brevifolia*, Parn.; *A. pseudo-alpina*; *A. alpina*, L.; *Poa glauca*, Sm.; *P. Balfourii*, Bab.; *Woodsia hyperborea*, Brown; *Cystopteris montana*, Link.

Mr. Joseph Sommerville made some remarks on the inflorescence of *Hedera Helix*, L., and drew attention to the stellate pubescence which covers the pedicels and calyces, a portion of which he showed under the microscope.

The following papers were read, viz.: "Experiments with Chilian Seed Potatoes—Report for 1884," by Mr. Thomas King;* "A Week at Glen Shee," by Mr. Peter Ewing.†

The Chairman referred to the loss which the Society is about to sustain by the removal from Glasgow to Manchester of Mr. Peter Cameron, one of the Vice-Presidents.

27th January, 1885.

Mr. Robert Turner, Vice-President, in the Chair.

On the motion of the Chairman the Society unanimously agreed to place on record their regret at the announcement of the death of Dr. Gwyn Jeffreys, the eminent conchologist.

The Chairman referred to a movement now being carried on for providing a suitable memorial to the late Mr. Roger Hennedy, formerly lecturer on Botany in Anderson's College, Glasgow, and author of the well-known *Clydesdale Flora*. Mr. Turner expressed the hope that the movement would meet with the support, not only of the Members of the Society with which Mr. Hennedy had long been connected, but of others interested in the diffusion of scientific knowledge, especially in that branch to which Mr. Hennedy had been attached.

The Secretary (Mr. Boyd) exhibited specimens of *Tetrodontium Brownianum*, Dicks., from Biglees Glen, near West Kilbride,

**Transactions*, i. 141. †*Id.*, i. 157.

and *Diphyscium foliosum*, W. and M., from Killin, and made some remarks on the structure of the peristome in these mosses.

Mr. C. Sherry exhibited a fine specimen of *Agave excelsa*, grown in the Royal Botanic Gardens, Glasgow, and he described the peculiar inflorescence and fructification of this plant. The genus *Agave* is one of the *Amaryllidaceæ*—an epigynous order, contrasting with the hypogynous *Liliaceæ*, and consisting chiefly of bulbous and scapigerous herbs, the genera *Agave* and *Fourcroya* being fibrous-rooted. The well-known *Agave americana*, sometimes erroneously named the "American aloe," is the plant commonly supposed to flower once in an hundred years. In cold climates, and with ordinary culture, there are no doubt long intervals between the times of flowering; but when it receives a culture similar to that of the pine-apple, it is found to flower more frequently. The flower-stalks are developed with wonderful rapidity. Some of them have been known to reach a height of 30 feet in as many days, and the specimen shown attained its full height of 12 feet in 18 days.

Mr. Thomas King exhibited a collection of Chilian Birds, on which he made some interesting descriptive remarks. The collection included the following species:

Falco sparverinus, L.—"Cernicalo," Sparrow-Hawk.

Strix cunicularia, Mol.—"Pequen," Burrowing-Owl.

Turdus Thilius, Mol.—"Trille" or "Chile," Yellow-winged Blackbird.

Sturnus militaris, L.—"Loica."

Fringilla Diuca, Mol.—"Diuca."

F. matutina, Licht.—"Chincol."

Tænioptera pyrope, Kittl.—"Diucon," Garnet-eyed Flycatcher.

Muscisaxicola niger.—"Animita," Flycatcher.

Regulus omnicolor, Vicill.—"Siete Colores."

Trochilus galeritus, Mol.—"Picaflor," Fire-crested Humming-Bird.

Oreotrochilus leucopleurus, Gould. — White-sided Mountain Humming-Bird.

Eustephanus fernandensis.—Isle of Juan Fernandez Humming-Bird.

Synallaxis ægithaloides, Kittl.—"Colelarga."

Thinocorus rumicivorus, Esch.—"Perdizita."

Ardea candidissima, Gay.—"Garza chica," Lesser White Heron.

Vanellus cayennensis, Gmel.—"Quiltegue," South American Lapwing.

Mr. James J. F. X. King exhibited living specimens of *Cæcilius Dalii*, M'Lach., taken by him on Camellias in the Royal Botanic Gardens, Glasgow; also specimens of *Agrypnia Pagetana*, Curt., from the neighbourhood of Glasgow.

Mr. R. Turner, Vice-President, read an interesting paper entitled "Thomas Hopkirk of Dalbeth: a Sketch of his Life and Botanical Work." *

24th February, 1885.

Dr. James Stirton, F.L.S., President, in the Chair.

Messrs. Fred. Lobnitz, Clarence House, Renfrew, and William Morton, 25 Dorset Street, were elected Ordinary Members.

Mr. William Craibe Angus exhibited an albino variety of the Woodcock, *Scolopax rusticola*, L., shot last winter in Argyllshire; also a hybrid between a Blackcock and Pheasant, bred at Loudoun Castle, Ayrshire, on the form and plumage of which he made some remarks. †

The Chairman referred to recent observations on the relation of albinoism to partial sterility, the result of which seemed to support the theory that among albino varieties there is a tendency towards a diminution in the number of offspring.

The Chairman exhibited a series of eight new forms of *Cladonia subsquamosa;* and in the course of some descriptive remarks he stated that the genus *Cladonia* is one of the most widely distributed of the lichen genera, being found not only in cold climes, but in the tropics, and extending from the sea-shore to the extreme verge of vegetation on the loftiest mountain ranges. It is found up as far as 17,500 feet on such mountains as the Himalayas, where it grows beneath the snow when that does not exceed three or four inches in depth. He then made some remarks on the new forms exhibited, and referred to the importance of chemical reagents in determining forms, which, although closely resembling each other externally, differed materially in their chemical constitution. A somewhat analogous relation had in like manner been shown to exist between the species in some genera of flowering-plants, — *Aconitum*, for example. Several of the Aconites were extremely poisonous, owing to the presence of aconitine, perhaps the most intense of all poisons; while the others were innocuous, owing to the entire absence of the poisonous element.

Mr. Donald Farquhar exhibited fertile specimens of *Pogonatum nanum*, Dill., collected by him in sandpits near Torrance-of-Campsie.

Mr. Thomas King exhibited specimens of *Encalypta vulgaris*, Hedw., var. *pilifera*, in fruit. These, Mr. King stated, he had collected at Mugdock, near Milngavie,—the only station in the district where the moss has as yet been observed.

* *Transactions*, i. 196. † *Id.*, i. 260.

The Secretary (Mr. D. A. Boyd) exhibited specimens of *Encalypta streptocarpa*, Hedw., in fruit, and remarked that while common in a barren state, this moss is rarely found bearing capsules. Last July he observed numerous fertile plants growing on a shaded bridge, near the south shore of Loch Tay, about a mile east from Killin village.

Mr. Ernest E. Barker exhibited a large piece of Red Coral, *Tubipora musica*, L., and several beautiful examples of Venus' Flower-basket *(Euplectella)*, on which he made some remarks.

Mr. John Blackwood exhibited a small collection of Foreign Timber from Barbadoes and other parts of the West Indies.

Mr. David Gregorson, F.E.I.S., read a paper entitled "Notes on the *Algæ* of the Kildonan Shore, Arran."*

31st March, 1885.

Mr. R. Turner, Vice-President, in the Chair.

Mr. Thomas Scott, Corresponding Member, exhibited the following species of Decapod Crustacea from the Clyde between Fort Matilda and Greenock, viz.:

Stenorhynchus tenuirostris, Leach.—Obtained from a fisherman, who found it clinging to his net. This species is remarkable for its attenuated beak.

Inachus dorsettensis, Penn.—Captured a short distance west from Battery Point.

Eurynome aspera, Leach.—Captured a short distance west from Fort Matilda.

Ebalia tuberosa, Penn.—This species belongs to a group of small Crabs possessing scarcely any rostrum. When alarmed it contracts its limbs, and then closely resembles a small pebble.

Mr. Scott stated that while these species had been previously taken in other parts of the Firth of Clyde, he could find no record of their having hitherto been observed in the Greenock district.

The Secretary (Mr. Boyd) exhibited specimens of the following Mosses, on which he made some remarks, viz.:

Dicranella rufescens, Turn.—Kirkland Glen, West Kilbride, in fruit.

Campylopus flexuosus, Brid.—Moors near West Kilbride, in fruit.

C. fragilis, B. & S.—West Kilbride and Ardrossan; frequent on banks, in woods, game-covers, &c., in fruit.

* *Transactions*, i. 170.

Ulota phyllantha, Brid.—West Kilbride; common on trees and walls, especially near the sea-shore.

Orthotrichum diaphanum, Schrad.—West Kilbride, in fruit.

O. rivulare, Turn.—On stones in the Kilbride Burn, near Seamill, in fruit.

Bryum alpinum, L.—Near Mugdock Castle, Milngavie.

Pogonatum nanum, Dill.—Blackshaw Quarries, near West Kilbride.

Climacium dendroides, W. and M.—Very abundant in fruit at Craigallian Loch, near Milngavie.

Brachythecium albicans, Neck.—Sandy fields at Poteath, near Hunterston, West Kilbride, in fruit.

Hypnum purum, L.—Seamill, West Kilbride, in fruit.

Hylocomium squarrosum, L.—Roadside at Mugdock village, near Milngavie, in fruit.

Mr. Thomas King exhibited a specimen of *Garrya elliptica*, a shrub introduced into this country from California, and now extensively grown for ornamental purposes. In the course of some remarks he drew attention to the peculiar amentaceous inflorescence, consisting of unisexual flowers, and other characteristics of the small order *(Garryaceæ)* originally founded for the reception of this species.

Mr. James J. F. X. King exhibited specimens of *Boreus hyemalis*, L., taken by him in Glen Lochay, Killin, on 23rd October last. He stated that the insect had been recorded for Scotland on two previous occasions only, having been taken first by Mr. James Hardy of Old Cambus in 1849, and subsequently in Aberdeenshire. Mr. King described the habits of the insect, which is only to be found between the months of October and March, and referred to the power which it possesses of leaping when disturbed, although the formation of its legs does not show how the motion is effected.

Mr. King also showed examples from Loch Awe, Lochgoilhead, and Fortingal, of *Hydroptila longispina*, M'Lach., and stated that the species had been recently described from specimens taken by him at Ambleside. On examining some insects since collected by him in Perthshire and Argyllshire, he had found among them the specimens now exhibited. Along with these was shown a drawing, on an enlarged scale, illustrating the points of distinction between this species and *H. femoralis*, Eaton, of which Mr. King exhibited specimens at a meeting of the Society on 3rd June last.

The following papers were read: "Notes on *Talitrus Locusta*, Linn.," by Mr. David Robertson, F.G.S., F.L.S.;* "Meteorolo-

* *Transactions*, i. 130.

gical Notes for 1884, with remarks on the State of Vegetation in the Public Parks of Glasgow," by Mr. Duncan M'Lellan, Superintendent of Parks;* "A Plea for the Study of Natural Objects," by Rev. John Muir; "A Curious Dwelling for a Hermit-Crab," by Mr. Thomas Scott, Corresponding Member.†

28TH APRIL, 1885.

Dr. James Stirton, F.L.S., President, in the Chair.

The following were elected Ordinary Members, viz.: Messrs. R. S. Wishart, M.A., 11 Gower Street, Kelvinside; Robert Service, Laurieknowe, Maxwelltown, Dumfries; and Robert Gill, 109 West George Street.

Mr. Thomas Scott, Corresponding Member, exhibited fertile specimens of the following Mosses from the Greenock district, viz.:

Breutelia arcuata, Dicks.—Shielhill Glen.

Pogonatum alpinum, L.—Rottenburn Glen.

Diphyscium foliosum, L.—Spring Dam, on the way to Loch Thom.

Neckera crispa, L.—Shielhill Glen.

N. complanata, L.—Duchal.

Hylocomium squarrosum, L.—Rottenburn Glen.

H. triquetrum, L.—Rottenburn Glen.

Mr. Peter Ewing exhibited several species of *Pottia*, and other small mosses, mounted as microscopic objects; and he stated that in preparing specimens for his herbarium he had found the ordinary method of gumming the plants to sheets of white paper to be productive of unsatisfactory results in the case of mosses so minute in all their parts. He had therefore mounted these plants in a manner better adapted for microscopic examination, and in this way the minute characteristics of each species could more easily be observed. The following was the medium employed, the specimens being mounted as transparencies on cards of a suitable size:—

7 parts pure glycerine, 1 part French gelatine, 6 parts distilled water; add 1 drop carbolic acid to every 100 drops of above mixture. The whole to be boiled till the flakes caused by the carbolic acid disappear, and filtered through spun crystal.

Mr. C. Sherry exhibited a male spike of *Ceratozamia mexicana*, Brong., one of the *Cycadaceæ*. It belongs to a group of palm-like, dwarf trees, with simple trunks having undeveloped internodes. The leaves, which are clustered at the summit of the

* *Id.* i. 123. † *Id.* i. 146.

trunk, are pinnate, parallel-ribbed, and circinate in vernation. The flowers are always dicœcious, the plants being therefore either male or female.

In *Cycas* the female flower consists of a rosette of foliage-leaves, the separate carpels being much smaller than the ordinary foliage-leaves, but essentially of the same structure.

The male and female flowers of the other genera of *Cycadaceæ*—*Macrozamia*, *Zamia*, and *Ceratozamia*—resemble fir-cones. In this species the stamen terminates in two curved points; and on the under surface are a number of pollen-sacs, very much like the sori of ferns. They dehisce longitudinally, and in all respects resemble more the sporangia of ferns than the pollen-sacs of phanerogams. The embryo of *Ceratozamia* has only one cotyledon, while *Cycas* and *Macrozamia* have two, and *Zamia* has three.

The arrangement of the reproductive organs over the leaf-like carpels and antheriferous scales in the *Cycadaceæ*, as well as the circinate vernation of their leaves, shows their affinity with the ferns. They are, however, more closely allied to the conifers, but are easily distinguished by the peculiar form of the branch-system on which the latter depend for their beauty, but which in the *Cycadaceæ* is wholly suppressed. They are distributed over Asia, Africa, and South America. The chief value of these plants is as sources of a kind of arrow-root or sago, consisting of the starch washed from the internal parenchyma of the trunks, or obtained from the mealy albumen of the seeds.

Mr. D. Gregorson, F.E.I.S., exhibited specimens of the Gulf-weed, *Sargassum vulgatum*, L., collected by a lady in the course of a voyage between Gibraltar and New York, in June last.

Mr. James J. F. X. King exhibited some additions to the entomological collections prepared for the Kelvingrove Museum, also nuclei for collections of *Micro-Lepidoptera* and *Psocidæ*.

Mr. King also showed specimens of *Eupœcilia Mussehliana*, Tr., a moth which is new to the Scottish Fauna, and is very rare in England, having only occurred in the counties of Pembroke and Devon; also specimens of *Bactra furfurana*, Haw., of which about twenty-five were taken by him at Loch Awe last summer.

Mr. David Robertson, F.L.S., F.G.S., sent for exhibition a specimen of *Ophiura albida*, one of the star-fishes, having an abnormal division of one of the rays. In the course of some descriptive notes, Mr. Robertson stated that with few exceptions the star-fishes have the power of reproducing their lost rays; and sometimes, where the new bud begins at the broken part, two rays come out instead of one. In such cases, however, one of the new rays is generally stronger than the other,

the lateral shoot in most cases, if not always, being the smaller of the two. This reproductive power seems to prevail more among the *Ophiuridæ* than the *Asteriadæ*, the members of which appear to be more subject to an abnormal number of rays. *Uraster rubens* is perhaps the species most subject to the renewal of parts. In the case of the specimen exhibited, which had a lateral branch springing from one of the rays, Mr. Robertson remarked that although it was no unusual thing for this species to have lost limbs reproduced, yet he had never before noticed a lateral branch on the rays, or a tendency to it, in *O. albida*. It did not appear certain that a part of the ray had at one time been broken off, but rather that there had been an injury at the point of division, which had induced the growth of the additional branch. If this had been so, we should have expected to find the normal ray longer and stronger than the new branch, which, however, is not the case; but there may have been some defect in the injured ray that allowed the new branch to acquire dimensions equal to those of the original ray.

The following papers were read, viz.: "Domestic Habits of Butter-fish," by Mr. W. Anderson Smith, Corresponding Member;* "The Disappearance of the Chough in the Stewartry of Kirkcudbright," by Mr. Robert Service;† "Notes on the *Neuroptera* of Argyllshire," by Mr. James J. F. X. King;‡ "Notes on Pedicellariæ," by Mr. David Robertson, F.L.S., F.G.S.;§ "The External Configuration of Plants in relation to Wind-Pressure and Water Currents," by Rev. Alexander S. Wilson, M.A., B.Sc.‖

* *Transactions*, i. 137. † *Id.*, i. 117. ‡ *Id.*, i. 163. § *Id.*, i. 132. ‖ *Id.*, i. 174.

ABSTRACT STATEMENT OF ACCOUNTS. — Session 1883-84.

To 213 Members' Annual Subscriptions @ 5s., -	£53	5	0	By Balance paid late Treasurer, - - - -	£14	0	11
,, 27 New Members' Entry-Money @ 10s., -	13	10	0	,, Rent, - - - - - - - - - -	7	10	0
,, 17 Members' Arrears, - - - - - -	7	15	0	,, Postages, Stationery, &c., - - - -	13	2	7
,, *Proceedings*, Catalogues, &c., sold, per Librarian,	9	1	0	,, Printing *Proceedings* and Circulars, - -	36	18	3
,, Balance due Treasurer, - - - - -	5	13	7	,, *Zoological Record* and *Year-Book of Scientific Societies*, - - - - - - - -	1	6	4
				,, Binding Books, - - - - - - - -	5	0	0
				,, Library, Postages, Carriage, &c., - - -	7	10	1½
				,, Cash in Librarian's hands, - - - -	1	10	10½
				,, Painting Bookcase, - - - - - -	0	18	8
				,, Advertising and Postages—Summer Session,	1	6	10
	£89	4	7		£89	4	7

Note.—Life Members' Subscriptions are in Savings Bank, and amount to £52. Interest on do., £2 0s. 9d.
There is in Treasurer's hands a sum of £6 (£4 further subscribed being not yet paid), for assisting in defraying expense of printing *Proceedings* in arrears. Additional subscriptions will be received by the Treasurer.

17*th October*, 1884.—Compared with Vouchers and found correct, Balance due to Treasurer being Five Pounds Thirteen Shillings and Sevenpence Sterling.

WILLIAM STEWART.
JOHN RENWICK.

SUMMER SESSION, 1885.

12th May, 1885.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. D. A. Boyd reported on the opening excursion of the season, made to Barrhead on Saturday, 9th inst. There was a good attendance of members, who, in spite of one or two heavy showers, had an enjoyable ramble on the Fereneze Braes. Vegetation was observed to be very backward, and few flowering plants were noticed, the only one worthy of note being *Chrysosplenium alternifolium*, L., which grew sparingly on the banks of a small stream. Many of the mosses, however, were in good condition; and among the species collected were the following:

Dichodontium pellucidum.
Webera nutans.
Pogonatum alpinum.
Polytrichum gracile.
Pterygophyllum lucens.
Eurhynchium piliferum.
Hypnum stellatum.
H. uncinatum.
H. patientiæ.

Mr. Boyd showed specimens of *Hypnum Schreberi*, Ehrh., in fruit, from the neighbourhood of West Kilbride, Ayrshire; and he reported that he had obtained a fertile plant of the same moss near Thornliebank early last spring. Although common enough in a barren state, this moss is rarely found bearing capsules—a characteristic common to many allied species of the genus to which it belongs.

Mr. Thomas King exhibited fertile specimens of the Great Water Horsetail, *Equisetum Telmateia*, Ehrh., from the neighbourhood of Innellan; and in the course of some remarks he drew attention to the great dissimilarity, in size and appearance, between the spore-bearing and barren forms of this plant.

Mr. William Gemmell exhibited specimens of the Marsh Marigold, *Caltha palustris*, L., showing the effect of a year's cultivation. The plants had assumed a more compact and robust habit, and their flowers had become double.

The remainder of the evening was devoted to the examination of a large and varied selection of microscopic objects, botanical and zoological, which were exhibited under a number of microscopes. The exhibition was extremely interesting and much enjoyed by a large company of members and their friends. Two incandescent electric lamps, in use on one of the tables, were found to provide excellent illumination for the surrounding microscopes.

26TH MAY, 1885.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. Richard M'Kay reported on an excursion made to Kilsyth on 23rd inst. Some of the party proceeded to Kilsyth Glen, while others walked across the hills to the picturesque Hermitage Glen on the River Carron. Among the plants observed were the following species:

Peucedanum Ostruthium.—Near Kilsyth.

Petasites alba.—Roadside above Kilsyth.

Listera cordata.—Moist ground on the Kilsyth Hills. This appears to be the nearest station to Glasgow yet reported for this plant.

Gymnostomum rupestre.—Moist rocks in the Hermitage Glen; very abundant with old capsules.

Dicranum majus.—Hermitage Glen; very luxuriant.

Bartramia Œderi.—Moist rocks in the Hermitage Glen.

Pogonatum nanum.—Roadside on Kilsyth Hills; barren.

Neckera crispa.—Hermitage Glen, on rocks; in fine condition, with numerous capsules.

Anomodon viticulosus.—Hermitage Glen, on rocks; of unusual size and beauty, but apparently barren.

Hypnum uncinatum.—Roadside near Hermitage Glen, and in the glen itself; very abundant, and copiously furnished with immature capsules.

Mr. D. A. Boyd made some remarks on a visit by him and Mr. D. Farquhar to the Loch Earn district on 21st inst. In Edinample Glen many interesting mosses were observed. At the head of the glen the ground was covered with a beautiful green carpet of *Hypnum uncinatum*, bristling with young fruit; and bright tufts of *Anœctangium compactum* were conspicuous on the moist rocks. *Gymnostomum rupestre*, *Mnium serratum*, and *Neckera crispa*, were abundant and in fine fruit; while at the foot of the glen, amidst the moisture afforded by the spray from a waterfall, *Mnium undulatum* and *Thamnium alopecurum* were found bearing capsules in plenty. Near Ardvoirlich, *Cinclidotus fontinaloides* was found in abundance on partially submerged stones at the side of the loch. Hundreds of bushes of *Prunus domestica*, covered with their conspicuous white blossoms, grew on the roadside along the north shore of the loch; and as far as the eye could penetrate the woods or reach the slopes of the hillsides, the pale yellow flowers of *Primula vulgaris* could be seen in countless numbers.

Mr. Boyd exhibited specimens of *Cinclidotus fontinaloides*, Hedw., which occurs on stones at the margins of most of the larger fresh-water lochs in the Highlands, but is rather rare in the South-West of Scotland.

Mr. W. Craibe Angus exhibited a partial albino example of the Blackbird, *Turdus merula*, L., having the head and neck white. He also showed a beautiful specimen of the Albatross, *Diomedea exulans*, which had been brought to this country preserved in ice, and had therefore the appearance of having only very recently been killed. Although stuffed specimens are common enough, this is probably the first time the bird has been seen here in the flesh. The wings measured from tip to tip nine feet, but the plumage seemed to indicate that the bird was not quite fully grown.

Dr. James Stirton, F.L.S., President, exhibited specimens of *Ruscus racemosus* from Algiers, and remarked that the shrub is said to have furnished the laurel-wreaths of ancient Rome.

Mr. James Barrie Low, M.A., exhibited a specimen of Toothwort, *Lathræa squamaria*, from Cotherstone, near Darlington.

Mr. Thomas King showed a portion of a root of an elm-tree from the banks of a stream near Glasgow. The soil having been washed away by the water, the exposed root ultimately developed leaf-buds, like a branch — a remarkable instance of functional change under altered conditions.

Mr. James J. F. X. King exhibited specimens of *Bactra furfurana*, Haw., which he had found in great abundance near Kilchurn Castle, Loch Awe; and *Pœdisca ophthalmicana*, Hub., from Cadder Wilderness, showing considerable departure from the typical markings of the species. The ground colour of the fore-wings was white, with a sprinkling of black and ochre scales along the costal margin, which left in prominence the spot on the dorsal margin near the base, and the ochre spot near the anal angle.

9TH JUNE, 1885.

Mr. Thomas King in the Chair.

Mr. D. A. Boyd reported on an excursion made to Dalry on 6th inst. The day was all that could be desired; and as the district was new to most of the members present, the excursion proved most enjoyable. Under the able leadership of Mr. John Smith, Kilwinning, Corresponding Member, the party proceeded along the old road from Dalry to Fairlie for several miles, returning by the valley of the Caaf. Vegetation was found to have made great progress since last excursion, and the mild weather had brought many of the summer flowers into full bloom. The highly fossiliferous limestone, for which the district is so well known to geologists, afforded some interest to the party; and visits were made to several exposed faces of the rock where an examination could more easily be made of the records of old-world life which the rocks so amply display.

Birkhead Glen, through which the water of Caaf descends, afforded a rich field to the botanists of the party. Mr. Boyd expressed the belief that the Dalry district was well worthy of the attention of the members, especially those engaged in the study of Cryptogamic Botany; and judging from the results of the excursion, he was of opinion that the district, with its varied geological formation, numerous streams, and shady glens, would, if carefully explored, be found to contain many rare and interesting plants.

Among the plants observed at the excursion were the following:

Geranium sylvaticum.—Frequent along the valley of the Caaf.

Viola lutea.—Common on the hilly pastures.

Prunus Padus.—Frequent, in fine flower.

Agrimonia Eupatorium.—Dry banks in Birkhead Glen.

Lythrum Salicaria.—Roadside near Holmbyre.

Peucedanum Ostruthium.—Frequent along the valley of the Caaf, forming large conspicuous patches on the banks of the stream.

Tanacetum vulgare.—Occasional, in large patches.

Anchusa sempervirens.—A few plants on the roadside near Auldmuir.

Verbascum Thapsus.—A single dead fruiting stem of last year observed in Baidland Quarry.

Aspidium aculeatum. } —Frequent on the shady rocks in
Scolopendrium vulgare. } Birkhead Glen.

Ophioglossum vulgatum.—Appears to be not unfrequent in the district. A single specimen was collected in a field at Baidland, and great numbers in immature fruit were observed on the moist slopes in the descent to Birkhead Glen.

Fontinalis antipyretica.—Common in shallow pools on the sides of the Caaf; in fruit.

Heterocladium heteropterum.—Common in Birkhead Glen, covering the surface of damp shady rocks; barren.

Plagiothecium pulchellum.—Birkhead Glen, chiefly growing through tufts of other mosses; in fruit.

Hyocomium flagellare.—Birkhead Glen; barren.

Mr. James J. F. X. King reported that on 6th inst. he had visited the River Garnock between Kilwinning and Dalry, and afterwards joined the excursion party. Among the *Neuroptera* captured by him were the following species:

Goëra pilosa, F.
Polycentropus flavo-maculatus, Pict. } —In profusion on the Garnock between Kilwinning and Dalry.

Berœa pullatus, Curt.—Three specimens taken on the Garnock.

Pyrrhosoma minium, Harr.
Ischnura elegans, Lind. } —These common Dragon-Flies were seen merrily dancing over the same pool on the Garnock.

Ecclisopteryx guttulata, Pict.—On the Caaf.

Philopotamus montanus, Donov. ,, ,,

Rhyacophila dorsalis, Curt. ,, ,,

Hydroptila forcipata, Eaton. ,, ,,

H. femoralis, Eaton (= *H. longispina*, M'Lach).—A large number of both conditions of this recently-described species were observed on the Caaf.

Mr. D. A. Boyd exhibited fruiting specimens of the following Mosses from the West Kilbride district:

Pottia Heimii, B. and S.—On moist turf on the sea-shore below Chapelton.

Dichodontium pellucidum, L., var. *serratum*, Schpr.—Biglees Glen.

Physcomitrium pyriforme, L.—Common on moist banks and sides of ditches.

Entosthodon Templetoni, Hook.—On a moist bank near Seamill.

Funaria fascicularis, Dicks.—On a moist bank between Seamill and Yonderfields.

Hyocomium flagellare, Dicks.—Biglees Glen; very rare in fruit.

Mr. Boyd also exhibited teratological specimens of White Clover, *Trifolium repens*, L., Dandelion, *Taraxacum officinale*, Wigg., and the Garden Strawberry, affording remarkable examples of the floral aberration known as "Phyllody." He also made some remarks on the extraordinary prevalence this season of *Æcidium grossulariæ*, DC., a fungus parasitic on shrubs of the genus *Ribes*, especially the Gooseberry, *R. Grossularia*, Currant, *R. rubrum et nigrum*, and Flowering Currant, *R. sanguineum*. In the case of the first-mentioned species, the parasite occurs in great abundance, not only on the leaves, but even on the young branches, while the fruit is so much disfigured by it that the value of the gooseberry crop is likely to be seriously affected this season. The fungus, which has also attacked the leaves and fruit of the currant, presents the appearance of bright orange-red patches, and these when ripe afford beautiful examples of the cluster-cup stage in the development of parasites of this order. As many of the Leaf-Fungi are now believed to pass through the metamorphic process of development known as "alternation of generation," appearing as "cluster-cups" on one species of plant and as "teleuto-spores" on another plant of a different tribe, it would obviously be of great importance to growers of fruit if the fungus could be recognised in this latter state, and destroyed

before it could attain a new lease of life as the parasite of the gooseberry. The life-history of this fungus is, however, comparatively obscure, but fruit-growers will look forward with interest to any fresh discoveries which may aid them in checking its ravages. In illustration of his remarks Mr. Boyd exhibited specimens of the leaves, young branches, and fruit of the gooseberry and currant, showing the effects of the parasite.

Mr. Robert Turner, Vice-President, stated that while any heterœcismal state of *Æcidium grossulariæ* is still unknown, "teleuto-spores" are said to have been observed on the gooseberry itself on the Continent, and, if so, the fungus is confined during its whole existence to the one plant.*

Mr. Donald Farquhar exhibited a tuft of *Encalypta streptocarpa*, Hedw., bearing about twenty well-formed capsules, found by him on a shady bridge near Edinample, Loch Earn, on 21st ulto. Fine specimens of *Mnium undulatum*, Hedw., in fruit, from the same district, were also shown.

Mr. William Gemmell exhibited a specimen of *Anchusa sempervirens*, L., from Tillietudlem.

Mr. James Steel showed some living specimens of Land-Shells from Gibraltar, including *Helix candidissima*, *H. aspersa*, and *Bulimus acutus*.

A note by Mr. David Robertson, F.L.S., F.G.S., on the Habits of *Pagurus Prideauxii*, was read.†

23RD JUNE, 1885.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. Donald Farquhar reported on an excursion made to Carluke on 20th inst. The party proceeded from Carluke Railway Station to Jock's Gill, thence to Milton Lockhart, and along the banks of Clyde to Crossford, returning to Carluke by Fiddler's Gill and Braidwood. As the day was very fine, the excursion was much enjoyed by all present. Among the plants observed were the following:

Trollius europœus.—Banks of Clyde between Milton Lockhart and Crossford.
Malva moschata.—Banks of Clyde below Crossford.
Hypericum hirsutum.—Frequent.
Geum intermedium.—Frequent.
Pyrus communis.—Milton Lockhart.
Galium boreale.—Banks of Clyde below Crossford.
Knautia arvensis.—Roadside near Crossford.
Crepis paludosa.—Frequent.

* See *Proceedings*, vol. v., p. 299. † *Transactions*, i. 290.

Tanacetum vulgare.—Crossford.
Doronicum plantagineum.—Crossford.
Campanula latifolia.—Frequent.
Ilex aquifolium.—Milton Lockhart.
Veronica montana.—Frequent.
Melampyrum sylvaticum.—Near Braidwood.
Mentha viridis.—Banks of Clyde.
M. sylvestris, var. *alopecuroides*, Hull.—Banks of Clyde.
Origanum vulgare.—Banks of Clyde.
Calamintha Clinopodium.—Banks of Clyde.
Epipactis latifolia.—Frequent.
Listera ovata.—Jock's Gill, Milton Lockhart, Fiddler's Gill.
Neottia Nidus-avis.—Jock's Gill.
Paris quadrifolia.—Fiddler's Gill,
Carex pendula.—Banks of Clyde.
Milium effusum.—Near Milton Lockhart.
Melica uniflora.—Near Milton Lockhart.
Bromus sterilis.—Roadside near Crossford.
Nephrodium Filix-mas var. *incisum*, Moore.—Jock's Gill.
Aspidium lobatum.—Jock's Gill.
Orthotrichum rivulare.—Stones in River Clyde; in fruit.
Cinclidotus fontinaloides.—Stones in River Clyde; in fruit.
Hypnum patientiæ.—Banks of Clyde; barren.
Hylocomium squarrosum.—Roadside near Jock's Gill; in fruit.
Æcidium grossulariæ.—Crossford.
Æ. urticæ.—Crossford.

The Chairman (Dr. Stirton) exhibited some fine specimens of the proliferous variety of the Garden Daisy known as "Hen and Chickens," and made some remarks on the abnormal development which they illustrated. He also showed a number of Lichens from New Brunswick, amongst which were two *Cladoniæ* new to science.

Dr. Stirton introduced Dr. Bell, who exhibited and presented to the Society a number of bones of the extinct *Moa* from New Zealand, also a heap of pebbles found beside the skeleton and presumably the contents of the bird's crop. The members examined these with much interest, and awarded a cordial vote of thanks to Dr. Bell for his kind gift.

Mr. Peter Ewing exhibited specimens of *Loiseleuria procumbens*, Desv., in flower, from Glen Shee.

Mr. D. A. Boyd and Mr. John Renwick showed some instances of abnormal growth in *Geum rivale*, L., and *Taraxacum officinale*, Wigg., gathered at the Carluke excursion. In the former case, the petals were much larger and more deeply coloured than usual, and the appearance of the plants was suggestive of a tendency towards a double-flowered sterile form; while, in the latter case, two scapes were united

throughout their whole length and somewhat flattened, affording an example of fasciation.

An exhibition of microscopic objects afterwards took place, an attractive feature of which was a Lantern Microscope with lime-light, shown by Mr. John Trotter. A large number of objects were exhibited, greatly magnified, on a white screen; and the ease with which the minute details of animal and vegetable structures could thus be examined afforded much satisfaction to all present.

28TH JULY, 1885.

Mr. R. Turner, Vice-President, in the Chair.

Mr. D. A. Boyd reported on an excursion made to Thornliebank on 1st inst. *Polemonium cæruleum*, L., was found growing abundantly, along with a white variety, on the banks of a dam at the head of the Rouken Glen; and *Avena flavescens*, L., a grass which is rare in the district, was also obtained in the glen. Specimens of *Succinea putris*, L., and *Planorbis contortus*, L., were collected by Mr. James Steel at the side of the dam.

Mr. Richard M'Kay reported on an excursion made to Ayr on 25th inst. The sea-shore below the town was examined for a distance of about two miles, but was found to be rather barren of shore plants. Among the plants collected were *Trifolium arvense*, L., *Eryngium maritimum*, L., *Convolvulus arvensis*, L., *Campanula Trachelium*, L., and *Salsola Kali*, L. *Allium vineale*, L., was found growing on the banks of the River Doon.

Dr. James Stirton, F.L.S., President, reported on an alpine excursion to the Killin district during the Glasgow Fair Holidays, when many of the flowering-plants, mosses, &c., for which the district is famed, were observed on Ben Lawers and Ben Challum, the mountains visited. He referred especially to a visit he had made to Creag Mor, between the head of Glen Lochay and Glen Lyon, when he was accompanied by Mr. James M'Andrew, New Galloway. There are two corries shown on the Ordnance Survey Map, neither of which can be ascertained to have been explored by botanists. Of these the more distant from Killin is visible during the ascent of Ben Challum; while the nearer, which extends for a distance of about a mile and a half, runs in a south-easterly direction, thus corresponding in aspect with both the corries on Ben Lawers. The latter was the corry visited by Dr. Stirton and Mr. M'Andrew. At first the appearance of the rocks seemed directly against the supposition of such plants being found as one might expect to meet with on Ben Lawers, the formation being of a type less favourable to vegetation; but after having ascended the

corry rather more than half-way, however, a detached group of schistose rocks was reached, where Dr. Stirton suddenly came upon a number of alpine plants not previously observed by him in the course of the ascent. These included *Sagina saxatilis*, Wimm., *Silene acaulis*, L., *Draba incana*, L., *Alchemilla alpina*, L., *Aspidium Lonchitis*, Sw., *Asplenium Trichomanes*, L., *A. viride*, Huds., &c. At the very summit of this corry he was delighted to find a perfect garden of alpine plants, similar, but on a smaller scale, to those on Ben Lawers. The two plants first seen, and conspicuous at a distance on account of their abundance, were *Trollius europæus*, L., and *Geranium sylvaticum*, L. Referring to the occurrence of these plants on alpine rocks, Dr. Stirton remarked that he always regarded their presence as auguring well for successful botanical research. Although he could only afford to devote about twenty minutes to the observation of the flowering plants, he was able to report the following species, in addition to those already referred to, viz.: *Arabis petræa*, Lam., *Cherleria sedoides*, L., *Saxifraga oppositifolia*, L., *Vaccinium uliginosum*, L., in flower, *Veronica humifusa*, Dicks., *Bartsia alpina*, L., *Salix reticulata*, L., and several other species of that genus, *Kobresia caricina*, Willd., *Carex atrata*, L., *C. rigida*, Good., *C. pilulifera*, L., and *C. pallescens*, L. As the rocks extended in terrace over terrace, a more prolonged search would doubtless have revealed many additional species of rarity and interest.

Mr. D. A. Boyd gave an account of a fortnight's visit to the same district, and referred to some of the rare alpine plants he had obtained during that period.

Mr. Thomas King reported that Mr. George Horn and he had recently visited the Cockle Shore, Bute. Among the plants observed were *Cardamine pratensis*, L., abundant in fruit—a rather rare occurrence, as in Scotland the seeds are seldom found perfectly matured; *Hypericum Elodes*, L., *Peplis Portula*, L., *Veronica Anagallis*, L., and *Alisma ranunculoides*, L. The Fairy-ring Fungus, *Marasmius oreades*, Fr., was also found in fine condition. About an hour's fruitless search was made for *Scutellaria minor*, L., reported for Cockle Bay by Mr. Hennedy, and also found since Hennedy's time by Mr. Horn.

Mr. King exhibited specimens of *Agaricus (Lepiota) cristatus*, Fr., a fungus found growing in a hot-house at the Royal Botanic Garden, and usually met with in gardens and cultivated ground.

Mr. William Stewart showed a magnificent Flower-Coral, kindly lent for exhibition by Mr. James Longden, Sauchiehall Street. The coral, which was obtained at Madagascar, measured about 21 inches across the surface.

11TH AUGUST, 1885.

Mr. Peter Ewing in the Chair.

Mr. D. A. Boyd reported on an excursion made to Langbank on 8th inst., when the members were met by Dr. Marcus Calder, Secretary of the Greenock Natural History Society, who kindly acted as leader. The shore east from Langbank was first visited, and after a turn through the neighbouring woods the party proceeded to Bishopton. The following were among the plants observed:

Ranunculus sceleratus.
Cardamine amara.
Stellaria nemorum.
Spergularia rubra.
S. neglecta.
S. marginata.
Circæa lutetiana.
Pimpinella Saxifraga.
Œnanthe crocata.
Carum verticillatum.
Juncus Gerardi.
Zostera marina.
Ruppia rostellata.
Scirpus Tabernæmontani.
S. maritimus.
Asplenium Ruta-muraria.
Dicranum majus.
Campylopus fragilis.
C. atrovirens.
Amphoridium Mougeotii.
Bartramia pomiformis.
B. ithyphylla.
Neckera crispa.

Mr. Boyd showed specimens of *Ruppia rostellata*, Koch., in flower and immature seed, and made some remarks on the characteristics of the plant. It is rare in the West of Scotland, but has been recorded for Dundonald, West Kilbride, Lesser Cumbrae, and Kilcreggan. The old records relate to "*R. maritima*, L.," which has been divided by modern botanists into the two species *R. spiralis*, Hartm., and *R. rostellata*, Koch; but the former of these does not appear to have yet been found in the South-Western counties. Although occurring in some abundance on the muddy shore of the River Clyde at Langbank, within high-water mark, its presence in the locality seems hitherto to have been overlooked. The plant is not included in Hennedy's *Clydesdale Flora.**

Mr. Boyd also showed a specimen of the fruit of the Hornbeam, *Carpinus Betulus*, L., from West Kilbride, on which he made some remarks.

Mr. Peter Ewing gave an account of a visit to Ben Lawers in July, and referred to the state of the vegetation on that mountain this season as contrasted with previous years. Although he had visited Ben Lawers for a good many consecutive summers, he had never found vegetation so much retarded, and this he ascribed to the long-continued easterly winds in spring and early summer. He had met no one who remembered a season in which the snow had lain so long. Among the plants referred to by Mr. Ewing were the following:

* See *Proceedings*, vol. v., p. 227.

Draba inflata, Hook.—Still maintains its position.
D. rupestris, Br.—This plant is becoming rare round the huts, but is spreading downward as far as 3000 feet.
Alsine rubella, Wahl.—Only beginning to appear.
Sagina nivalis, Fries.—Apparently not yet above ground.
Saxifraga nivalis, L.—This plant seems to be getting rare.
S. cernua, L.—Also scarce and in poor condition
Juncus castaneus, Sm.—Only just above ground.
J. biglumis, L.—In good condition.

The mosses were in fine condition, and many that are rare in fruit were found bearing plenty of capsules.

Mr. Thomas King exhibited Flowers and Leaves of New Zealand Flax, *Phormium tenax*, from a garden at Innellan. The plant rarely flowers in this country, but has done so in several localities this summer. It produces its flowers in a spike about nine feet in length.

Mr. King read a paper on "Stipules," in which he referred to the structure, modifications, and functions of these organs. He also made some remarks on the ligule of grasses, which has been considered by many botanists to be of this nature; but it seems rather to be simply a prolongation of the thin skin or epidermis which lines the inner surface of the leaf-sheath. A large series of illustrative specimens was also exhibited by him.

25TH AUGUST, 1885.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. D. A. Boyd reported on an excursion made to Largs on 22nd inst. Mr. Richard Browne of Haylie kindly received the members of the party, conducted them through his grounds, and entertained them to luncheon, after which they were joined by several members of the Greenock Natural History Society. A visit was made to a remarkable cromlech or sepulchral chamber, situated in the grounds at Haylie. This chamber seems to have been constructed of four large flat stones set on edge, with a larger slab forming the cap-stone or lid; but one of the end stones has apparently been removed. When emptied of its contents, it is said to have measured not less than six feet in depth. In common with most of the tumuli and other ancient sepulchral remains in the district, it has been popularly assigned to the period of the Battle of Largs (1263); but the structure of the sepulchre itself, and the urns and traces of incineration which it contained, indicate a much earlier origin,

dating back to prehistoric times.* Through the kindness of Mr. Alexander Crum, M.P., access was obtained to the Kelburne estate; and some time was pleasantly spent in exploring the woods and visiting the gardens. Among the plants observed at Haylie were the following:

Valeriana pyrenaica.
Doronicum Pardalianches.
Arum maculatum.
} Abundant in the woods, but apparently introduced.
Boletus luteus.
B. flavus.
B. erythropus.
Polyporus squamosus.
P. versicolor.

The following were observed in the Kelburne woods:

Sagina nodosa.
Hypericum hirsutum.
Eupatorium cannabinum.
Campanula latifolia.
Calamintha Clinopodium.
Melica uniflora.
Milium effusum.
Brachypodium sylvaticum.
Aspidium aculeatum.
A. angulare.
Asplenium Adiantum-nigrum.
Scolopendrium vulgare.
Ditrichum homomallum, in fruit.
Webera albicans, in fruit.
Neckera pumila.
Pterogonium gracile.
Plagiothecium sylvaticum, in fruit.
Hypnum resupinatum.
Usnea barbata.
Alectoria jubata.
Evernia prunastri.
Peltigera canina.
P. rufescens.
Sticta pulmonacea
Parmelia caperata.
Agaricus (Tricholoma) rutilans.
A. (Collybia) radicatus.
A. (Hypholoma) fasciculares.
A. (Hypholoma) velutinus.
Coprinus plicatilis.
Gomphidius viscidus.
Russula heterophylla
R. fœtens.
R. fellea
R. ochroleuca.
Phallus impudicus.
Puccinia mœhringiæ, on *Arenaria trinervis.*
Rhytisma acerinum.
Sphærotheca Castagnei, on *Humulus Lupulus.*

* "HAILY.—This place is supposed to have had its name from *Helle*, a pit or burial place; as here a vast tumulus had been erected over the bodies of the slain, as thought, at the Battle of Largs. It was only discovered, however, about 40 years ago, by Mr. Wilson, when searching for stones to enclose his lands. It was till then known by the name of Margaret's Law, and was supposed to be natural. It had long been overgrown with rank herbage and brushwood. In the centre of it were found five stone-coffins, or square apartments formed with flat stones set on edge; two of them containing five skulls each, with other human bones and several earthen urns. The earth and small stones at the bottom were *calcined*. It is supposed that the skulls and other bones within these coffins were those of the chiefs; whilst the bodies of the common warriors had been thrown promiscuously over them, and then stones, in vast quantity, heaped over all. These amounted to upwards of 5,000 cartloads; while the quantity of bones, which, on exposure, crumbled into dust, was immense."—George Robertson, *A Topographical Description of Ayrshire, more particularly of Cunninghame* (1820), p. 111.

Mr. Boyd exhibited specimens of the following plants, on which he made some remarks, viz.:

Radiola millegrana, Sm.—Moist ground at Biglees, West Kilbride.

Pyrola uniflora, L.—Found by Mr. James J. F. X. King at Loch Morlich, Inverness-shire.

Utricularia vulgaris, L. } —Very abundant in Knockewart
U. minor, L. } Loch, Ardrossan.

Hypnum giganteum, Schpr.—Knockewart Loch, Ardrossan; Clober Moor, near Milngavie.

Mr. David Gregorson, F.E.I.S., submitted the following list of the *Algæ* found at the dredging excursion to Millport on 15th inst., viz.:

Halidrys siliquosa.
Fucus vesiculosus
F. serratus.
F. nodosus.
F. canaliculatus.
Desmarestia aculeata.
Laminaria digitata.
L. bulbosa.
L. saccharina.
Chorda filum.
Dictyota dichotoma.
Chordaria flagelliformis.
Mesogloia vermicularis.
Sphacelaria cirrhosa.
Odonthalia dentata.
Polysiphonia parasitica.
P. fastigiata.
P. nigrescens.
Bonnemaisonia asparagoides.
Lomentaria kaliformis.
Corallina officinalis.
Melobesia calcarea.
M. polymorpha.
Delesseria sinuosa.
D. alata.
Nitophyllum laceratum.
N. Hilliæ.
Maugeria sanguinea.
Rhodymenia palmata.
Cystoclonium purpurascens.
Callophyllis laciniata.
Gigartina mamillosa.
Furcellaria fastigiata.
Ceramium rubrum.
Ptilota plumosa.
Codium bursa.
Enteromorpha intestinalis.
E. compressa.
Ulva Linza.
U. latissima.
Cladophora rupestris.
C. arcta.

The Chairman (Dr. Stirton) gave an interesting account of a recent visit to the Outer Hebrides. A careful search was made by him for the rare moss *Myurium Hebridarum*, Schpr.; and after he had almost despaired of finding it, it was discovered on South Uist and afterwards on Benbecula and Barra. Dr. Stirton exhibited specimens from South Uist; and in the course of some remarks on the distribution of the moss, he stated that it had now been found in the Azores, Madeira, Barra, South Uist, Benbecula, and North Uist—all islands of the Atlantic chain. With the exception of Cape of Good Hope, it has been found nowhere else. Among the plants observed by Dr. Stirton on Benbecula were the following:

Ligusticum scoticum, L.
Erythræa Centaurium, Pers. —A broad-leaved form.
Anagallis tenella, L.—Common.
Blysmus rufus, Link.
Scirpus fluitans, L.
Osmunda regalis, L.
Ophioglossum vulgatum, L.

Mr. David Gregorson, F.E.I.S., exhibited a specimen of *Batrachospermum vagum*, gathered at Corrie, Arran, by Mr. Cook, Paisley.

Mr. John Renwick exhibited specimens of *Convolvulus arvensis*, L., from Maryhill; also *Saponaria Walkeri* from the same district, but presumably an escape from cultivation.

Mr. George R. Alexander gave an interesting account of a recent visit to the Naples Aquarium. After describing the contents of the principal tanks, he referred to some of the important features in the management of the institution.

8TH SEPTEMBER, 1885.

Mr. Thomas King in the Chair.

Mr. D. A. Boyd reported on an excursion made to Kilwinning on 5th inst. The members were met on arrival by Mr. John Smith, Corresponding Member, and Dr. A. Milroy and Mr. Boyd, Kilwinning. Under the leadership of Mr. Smith the party proceeded along the north bank of the Garnock from the Eglinton Iron-Works to Misk, and thence across the Ardeer sand-hills, returning to Kilwinning by Stobs A "scraper" of chipped flint was found on the sand-hills, and numerous fragments of coarse pottery, some of them slightly glazed and ornamented with incised lines, &c. Although of coarse structure, and obviously of considerable antiquity, the appearance of the pottery indicated that it had been produced with mechanical aid. Through the kindness of Mr. Smith, the party had an opportunity of inspecting his ample collection of flint arrow-heads and chipped implements, many of which had been found by him on the adjacent sand-hills. Among the plants observed were the following:

Brassica monensis.
Silene maritima.
Radiola millegrana.
Geranium pratense.
Erodium cicutarium.
Ornithopus perpusillus.
Drosera rotundifolia.
Lythrum Salicaria.
Peplis Portula.
Conium maculatum.
Helosciadium inundatum.
Aster Tripolium.
Artemisia vulgaris.
Filago minima.
Senecio sylvaticus.
Pyrola minor.
Calystegia sepium.
Echium vulgare.
Solanum Dulcamara.
Armeria vulgaris.
Salix repens, L., var. *argentea*, and several other forms.
Triglochin maritimum.
Juncus Gerardi.
Blysmus rufus.
Phragmites communis.
Bromus sterilis.
Lycopodium inundatum.
Pogonatum nanum.
Coleosporium Tussilaginis.

Mr. Boyd exhibited a fertile specimen of *Lycopodium inundatum*, L., found growing very sparingly on a moist spot on the

Ardeer sands. This plant does not appear to have hitherto been observed in Ayrshire, nor does there seem to be any record of its having been found in any of the adjacent South-Western counties. According to Watson's *Topographical Botany*, it has been reported from 10 of the 41 Scottish vice-counties, viz., Fife, Perth (mid), Perth (east), Forfar, Kincardine, Elgin, Easterness, Dumbarton, Ross (west), and Ross (east). It has been reported from 50 of the 112 British vice-counties.

Mr. James Steel made some remarks on the dredging excursions of 15th August and 5th September. A number of interesting zoological organisms had been obtained; but as these were chiefly of a minute size and obscure character, a detailed report could not at present be furnished. A fine specimen of *Amphioxus lanceolatus* had been brought up by the dredge.

An exhibition of microscopic objects afterwards took place.

WINTER SESSION, 1885-86.

29TH SEPTEMBER, 1885.

Mr. David Gregorson, F.E.I.S., in the Chair.

Messrs. Alexander Leitch, 60 Rosebank Terrace, and Graham R. Bell, 66 West Princes Street, Helensburgh, were elected Ordinary Members.

Mr. D. Corse Glen, C.E., F.G.S., the Society's delegate to the Aberdeen Meeting of the British Association, gave an interesting account of the proceedings at the various meetings and excursions.

Mr. James Steel exhibited specimens of *Melampus bidentatus*, Mont., from Tarbert, Loch Fyne, and made some remarks on the apparently anomalous character of the genus.

Mr. Steel also showed specimens of *Cypridopsis orba*, Brady, *Candona tenuis*, Brady, and *Cypris bombycina*, Brady, three species of *Ostracoda* from New Zealand, recently received by him from Mr. Thomas Steel, Sydney, New South Wales, and forwarded to Dr. G. S. Brady, F.R.S., F.L.S., &c., who has pronounced them new to science.

Mr. D. A. Boyd exhibited specimens of *Scirpus Holoschœnus*, R. & S., recently collected by Mr. W. B. Waterfall, Bristol, at Braunton, North Devon, where this very rare species has long been known to occur. He also showed specimens of *Camptothecium nitens*, Schreb., obtained in the neighbourhood of Killin by Mr. G. H. Binstead, Kendal.

Mr. Peter Ewing showed fertile specimens of *Camptothecium lutescens*, Huds., from Ben Laoigh, Perthshire.

Mr. John Renwick exhibited a specimen of *Scutellaria minor*, L., from the neighbourhood of Rothesay, and made some remarks on the rarity of the plant in the Clyde district.

Mr. James J. F. X. King exhibited a specimen of *Drepanopteryx phalœnoides*, L., one of the Lace-wing Flies, and stated that the species is so rare in this country as to have been regarded as almost, if not altogether, extinct. Prior to the capture of this insect by Mr. K. J. Morton and Mr. King near Cleghorn during the present month, it had not been taken in Britain for twenty-nine years, or in Scotland for fifty-seven years.

A paper was read by Mr. John Broom giving an account of an excursion to the Scuir of Eigg, and describing some of the interesting features of the island. Some remarks were afterwards made by Mr. D. Corse Glen, C.E., F.G.S., and Mr. James Thomson, F.G.S., on the Geology of Eigg.

THE THIRTY FOURTH ANNUAL GENERAL MEETING.

27TH OCTOBER, 1885.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. D. A. Boyd referred to the death of Dr. Thomas Davidson, Brighton, one of the Honorary Members, which took place on the 14th inst.

IN MEMORIAM.

THOMAS DAVIDSON, LL.D., F.R.S., F.G.S., F.L.S.

THOMAS DAVIDSON was the eldest son of Captain William Davidson of Muir House, Midlothian. He was born in Edinburgh but spent his youth on the Continent, studying art in Paris under Horace Vernet and Paul Delaroche, and science under Brogniart, St. Hilaire, Milne Edwards, and others. After matriculating at the University of Edinburgh, he proceeded to Rome, where he resumed the study of art. The illustrations of his numerous monographs show how closely his favourite pursuits were afterwards linked, and how successfully his work—scientific, literary, and artistic—was pursued under the powerful stimulus of combined tastes.

At the suggestion of the eminent Prussian geologist, Baron von Buch, Mr. Davidson undertook the study of the *Brachiopoda*, a much-neglected group of *Mollusca*, of whose structure and distribution very little was then known. The remarkable assiduity with which this work was pursued may be realized from the fact that nearly 1,000 species, from the British fossiliferous rocks alone, were figured and described by him; and of these less than a third had been previously known to science. During the progress of this *magnum opus* he received contributions from Carpenter, Owen, and Murchison; and the work, when completed, was translated into French and German.

For more than forty years he laboured incessantly. Monograph after monograph appeared; and, in addition to these, numerous articles in the *Quarterly Journal of the Geological Society of London*, *Transactions of the Linnean Society*, *Annals and Magazine of Natural History*, *Geological Magazine*, &c. The article on "Brachiopoda," in the recent edition of the *Encyclopædia Britannica*, was from his pen; and, in the first Zoological Report of the *Challenger* expedition, the descriptions and figures of the recent species of these molluscs were contributed by him.

In 1857 he was elected a Fellow of the Royal Society, and in 1870 he received one of the Queen's gold medals in recognition of his scientific researches. For two years he acted as Honorary Secretary of the Geological Society, and in 1865 he received the Wollaston gold medal of that Society. At the meetings of the

British Association held at Edinburgh in 1871 and at Brighton in 1872, he was elected Vice-President of the Geological Section; and most of the leading scientific societies throughout Europe and America recognised his attainments by electing him an Honorary Member. In 1882 the University of St. Andrews conferred on him the honorary degree of LL.D.

As part of the results of his personal work in Italy and France, he had formed two valuable geological collections,—the one consisting of specimens of volcanic rock and products, and the other of an instructive series of the rocks and fossils of the Paris Basin. These were generously presented by him to the town of Brighton, for which his strenuous efforts and powerful influence had already obtained a Free Library and Museum. It is understood that his magnificent collections of British and foreign, recent and fossil, *Brachiopoda*, have been bequeathed to the nation, and will eventually be placed at South Kensington.

Dr. Davidson was elected an Honorary Member of this Society in 1880.

At the time of his decease he was in his 69th year—to most men a period ere which the more active labours of life have of necessity been laid aside; but when the enormous amount of work that he accomplished is taken into account, we can fully realize how intense must have been his devotion to science thoughout the whole course of his life, and how few and short his intervals of inactivity and rest can have been. As has been written of him by Mr. W. H. Dall, a sympathetic American fellow-worker, in the *Geological Magazine* of September last: "Seldom has fortune equipped more completely a student than in his case, where more than an ordinary artistic talent, a liberal education, and independent means, were joined to unsurpassed devotion in the pursuit of knowledge and impartiality in the recognition of the labours of others in the same field."

The Secretary (Mr. D. A. Boyd) read the Report of the Council on the business of last Session:

REPORT OF THE COUNCIL.

The Council beg to report that since the last Annual General Meeting 20 new Members have been added to the Roll of the Society; the number at present on the Roll being 12 Honorary, 28 Corresponding, and 237 Ordinary Members—Total Membership, 277.

Among the names occurring in the obituary record is that of Mr. James Napier, F.C.S., F.R.S.E., Maryfield, Bothwell. Mr. Napier was admitted a member on 7th October, 1851, a few months after the formation of the Society; and during the long period of his membership he always continued to take a warm interest in the Society's welfare.

During the past session the usual number of meetings were held, at which the attendance was good and the work satisfactory. At the summer meetings many interesting specimens were exhibited, and much valuable information recorded regarding the Fauna and Flora of the district. Several of the excursions were to places not previously visited by the Society; and while the results attained compare favourably with those of previous years, it is to be regretted that the Members do not more readily avail themselves of the advantages which these excursions afford for obtaining that wide knowledge of Nature that can best be acquired by means of field work.

Vol. v., Part iii., of the Society's *Proceedings* was issued to the Members at the close of last session; and during the summer the first part of the new series of *Proceedings and Transactions* was also published. Part ii., containing the work of last session, is almost completed and will shortly be ready for distribution. With the issue of this part, the publication of the *Proceedings and Transactions* will be brought up to date; and the future work of the Publishing Committee will be so conducted as to admit of each annual part being issued immediately after the close of the session to which it refers.

Along with the forthcoming part of the *Proceedings and Transactions* will be published *The Fauna of Scotland—Hymenoptera*, part ii., by Mr. Peter Cameron, containing much original information regarding the classification and distribution of that important family of Insects.

An *Index* to Vols. i.-v. of the *Proceedings* has now been prepared; and this, it is hoped, will prove of much value to all who are interested in the past work of the Society, or engaged in the study of the Fauna and Flora of the district. The Council desire to acknowledge the invaluable services of Mr. Richard M'Kay in the completion of this work, its entire compilation and arrangement having been undertaken by him, and accomplished in a manner worthy of the highest commendation.

As the efforts of the Council have during the past session been so largely directed towards the issue of the publications in arrear, they have been unable to devote to the Library the attention which that department has deserved. They trust, however, that ere long the numerous unbound works will be rendered available for reference, and that many recent scientific manuals, at present much required, will be added to the Library. Meantime, the liberal aid of the Members is solicited, either by subscription to the funds of the Library, or by the donation of new books.

Several additional collections are in course of preparation by the Museum Committee for the Kelvingrove Museum; and the co-operation of the Members is requested in promoting this important work.

In conclusion, the Council, while expressing their gratification at the work accomplished during the past session, trust that the individual efforts of the Members will continue to be directed towards the extension of the work of the Society. There is still room for advancement in this direction; and while much may be attained even by a few earnest workers a much larger measure of success is certain to result from the combined efforts of all.

On account of the absence, through illness, of the Treasurer (Mr. M. C. Duff), the Secretary (Mr. W. Goodwin) submitted an *interim* Abstract of Accounts, and stated that a correct

Financial Statement would afterwards be prepared by the Treasurer and submitted to the Members.

Mr. James J. F. X. King, Librarian, reported as follows:

The Books are in good condition with the exception of some of the volumes of Sowerby's Botany, the binding of which is becoming worn out owing to their being more used than any other work in the Library.

Upwards of 500 separate publications, contributed by our numerous corresponding Societies, Magazines, Institutions, &c., have been added during the past session. The thanks of the Society are especially due to the Directors of the United States Geological Survey for the excellent set of Monographs, &c., which they have recently forwarded to us.

The Library now contains 678 bound volumes, being an increase of 80 since last report.

Although each succeeding year shows a steady increase in the number of volumes issued, it is still to be regretted that Members do not avail themselves of the opportunities of consulting the works more frequently, as it is only by so doing that they can arrive at any conclusion as to the value of the various *Proceedings* of Foreign Societies. During the session 194 volumes have been issued (of which 88 were given out during the summer), as compared with 189 volumes during session 1883-84.

The Society's *Proceedings*, vol. v., part iii., has been forwarded to 118 Societies, Magazines, &c.; while vol. i. (n.s.), part i., has been sent to 120 Societies, &c.

The Reports were all unanimously approved and adopted.

The Society then proceeded to the election of Office-Bearers, when Mr. James Dairon, F.G.S., was elected a Vice-President, and Messrs. George R. Alexander, William Craibe Angus, and James Barrie Low, M.A., Members of Council,—the Council being as follows: President, James Stirton, M.D., F.R.C.S.Ed., F.L.S.; Vice-Presidents, Henry E. Clark, M.R.C.S., Robert Turner, and James Dairon, F.G.S.; Secretaries, D. A. Boyd and William Goodwin; Treasurer, M. C. Duff; Librarian, James J. F. X. King; Members of Council, David Gregorson, F.E.I.S., D. Corse Glen, C.E., F.G.S., Freeland Fergus, M.B., Thomas King, John Kirsop, F.S.A.Scot., Richard M'Kay, George R. Alexander, W. Craibe Angus, and James Barrie Low, M.A.

Messrs. John Renwick and William Stewart were appointed Auditors for the ensuing year.

Mr. John Trotter, 12 Buccleuch Street, Mr. Andrew C. Whyte, L.D.S., 42 Dundas Street, and Professor F. O. Bower, M.A., F.L.S., Glasgow University, were elected Ordinary Members.

Mr. D. A. Boyd reported that when visiting the woods near Crosbie Castle, West Kilbride, on 26th ult., along with Messrs. Thomas King and Richard M'Kay, he had observed *Carex*

lævigata, Sm., and *Cynophallus caninus*, Fr., both of which are somewhat rare in the district.

Mr. James Steel exhibited a number of miscellaneous Natural History objects, received from Mr. Thomas Steel, Sydney, New South Wales. Among these was a specimen of *Echinus chloroticus*, a species which resembles considerably the Common Sea-Urchin of our coasts, but is rather flatter in shape.

Mr. James Barrie Low, M.A., exhibited portions of the skin, vertebræ, and teeth from the lower jaw of the Common White Shark, *Carcharias vulgaris*, on which he made some remarks.

Mr. Duncan Mackenzie exhibited three Snakes from South Australia.

Mr. Thomas King showed the following species of *Fungi* collected at Tillicoultry, viz.:

Agaricus (Amanita) muscarius, L.

Lactarius camphoratus, Fr.—So named from its peculiar odour, which resembles that of the Melilot. This species, which appears to be somewhat rare in Scotland, has been observed in the Craigton Woods, near Milngavie, and in Cadder Wilderness.

L. vellereus, Fr.—Remarkable for the woolly down which clothes the surface of the pileus.

Cantharellus cibarius, Fr.—Although usually occurring in tolerable plenty, the Chanterelle has been rather rare this season, owing, no doubt, to the unfavourable weather which retarded the growth of *Fungi* generally.

Boletus edulis, Bull.—Found in very fine condition, one of the specimens measuring nine inches across the surface of the pileus.

B. variegatus, Fr.

B. luridus, Fr.

The President delivered an address on the glacial period and its influence on the distribution of cryptogamic plants. After explaining the principal theories regarding the origin and extent of the great ice currents, he referred particularly to some apparent anomalies in the distribution of several species of mosses and lichens which occurred in single isolated stations in countries widely separated,—Ben Lawers, for example, affording several striking instances. These plants probably represent the remnant of a preglacial flora, which, from situation and other causes, escaped destruction during the ice age. An observation of the area of growth of these species enables us to determine the probable extent and effects of the great glacial movements. In illustration of his remarks, Dr. Stirton exhibited specimens of *Ptychodium plicatum*, *Myurium Hebridarum*, *Camptothecium nitens*, *Hypnum Oakesii*, *Chlorea vulpina*, and *Umbilicaria rugifera*.

24th November, 1885.

Mr. Robert Turner, Vice-President, in the Chair.

The following gentlemen were elected Corresponding Members, viz.: Messrs. J. T. Cunningham, B.A., F.R.S.E., Scottish Marine Station, Granton; John Rattray, M.A., B.Sc., F.R.S.E., Scottish Marine Station, Granton; J. R. Henderson M.B., F.L.S., Professor of Biology, Christian College, Madras; Frederick G. Pearcey, *Challenger* Expedition Office, Edinburgh; and James M'Andrew, New Galloway.

The following were elected Ordinary Members, viz.: Messrs. Robert S. Houston, Hope Villa, Bellahouston; George E. Mann, 3 Salisbury Quadrant, Strathbungo; Duncan M'Laren, 1 Greenbank Street, Pollokshaws; James Hamilton, 60 Wilson Street; John Tennant, 19 The Boltons, London, S.W.; Thomas F. Gilmour, M.D., 231 Paisley Road, West; Alexander M'Nair, 62 Bath Street; Marshall Reid, Eel River, Ristigouche County, New Brunswick; and William Dow, 165 Hospital Street.

Mr. A. Somerville, B.Sc., F.L.S., exhibited specimens of several species of Decapod Crustacea. Among these were the following:

Galathea strigosa, L.—Sound of Mull, under stones at low water. Along with this was shown, for comparison, a specimen from the coast of Cornwall, kindly lent for exhibition by Mr. James Paton, F.L.S., Curator, Kelvingrove Museum, also examples of *G. squamifera*, Leach, from Mull.

Xantho florida, Mont.—Specimens of this, the less common of the two Scottish species of *Xantho*, were obtained in the Sound of Mull, and at Eigg, under stones at low water. There were also shown for comparison examples of *X. rivulosa*, Risso, from Mull, and *X. tuberculata*, Bell, from the English Channel.

Pirimela denticulata, Mont.—New to the West of Scotland; dredged by Mr. Somerville in Gairloch, West Ross-shire, on muddy sand, in about 20 fathoms water. An enlarged sketch of this crab was shown, illustrating the peculiar form and marginal toothing of the carapace.

Mr. James Steel exhibited an extensive collection of shells from New Zealand, South Australia, and South Africa. In the course of some remarks, Mr. Steel referred to several common British species which had been introduced at the antipodes and were now quite naturalized. *Helix aspersa*, L., for example, appeared to thrive well under its new conditions, the only remarkable change being the thinness of the shell as compared with those of British specimens. Rev. James E. Somerville, B.D., Corresponding Member, also made some remarks on this subject, and stated that *H. aspersa* had also been introduced

into South Africa, at Capetown, by a Frenchman, for gastronomic reasons. In this case the shell showed a tendency to become thicker.

Mr. Robert M'Lellan exhibited a proliferous monstrosity of the Garden Rose. From the centre of the flower proceeded a second peduncle, bearing at its apex an additional flower-bud. The petals of the larger (normal) flower were much elongated and embraced the additional peduncle. Mr. M'Lellan stated that the parent bush, which is trained up the side of a house in Perthshire, had this season borne only the monstrosity exhibited; but that he had frequently seen such abnormal forms in the flowers of the Boursault Rose. In the course of some discussion on the tendency in the rose to produce abnormal flowers, it was remarked that while such aberrations are much more abundant in some seasons than in others, in many cases they are observed on the same bush in successive years, showing that their presence is frequently due to some change in the constitutional character of the bush.

The following papers were read:—"Biological Notes," with illustrative specimens, by Mr. Peter Cameron; * "The Decapod and Schizopod Crustacea of the Firth of Clyde," by Mr. J. R. Henderson, M.B., F.L.S. †

29TH DECEMBER, 1885.

Dr. James Stirton, F.L.S., President, in the Chair.

The Chairman referred in feeling terms to the loss which the Society has sustained in the death of Mr. M. C. Duff, the Treasurer; and it was unanimously resolved that a notice of Mr. Duff's death should be recorded in the minutes, and an extract therefrom forwarded to the relatives of the deceased, with an expression of the sympathy of the Members of the Society with them in their bereavement.

IN MEMORIAM—M. C. DUFF.

MUNGO CAMPBELL DUFF was born in Edinburgh, but received his education and business training in Glasgow. Along with the other members of the Glasgow Society of Field Naturalists, he was admitted a member of the Natural History Society of Glasgow on the amalgamation of the two Societies at the closing meeting of the Session 1878-79. While making no pretensions to scientific attainments in any department of Natural History, Mr. Duff took a keen interest in all the work of the Society, contributing to the meetings by the exhibition of specimens in various branches. His special leaning was to Cryptogamic Botany, in one section of which—viz., the Ferns—he had acquired, and cultivated in his greenhouse, a complete collection of the British species, with many rare and interesting

* *Transactions*, i., 295. † *Id.*, i., 315.

varieties, found mainly by himself in their native habitats. His energetic business habits and sterling character commended him for office, and he was elected a Member of Council in September, 1881. In this capacity his services were so much appreciated that on the Treasurership becoming vacant in 1884 he was unanimously elected to that office, which he held until his death on 28th December, 1885. Although, to a stranger, Mr. Duff may at first have appeared somewhat retiring, this apparent reserve was found to disappear on a better acquaintance; and his straightforward manner, keen sense of honour, and warm affections, endeared him to all who were privileged with his friendship. In him the Society has lost a warm friend and an efficient office-bearer.

Mr. John Murray, *Challenger* Expedition Office, Edinburgh, was elected an Honorary Member.

Rev. James Fordyce, Bishopbriggs, and Mr. Adam Murdoch, 174 Garscube Road, were elected Ordinary Members.

Mr. William Watson exhibited some of the rarer species of *Lepidoptera*, with a number of interesting examples which showed considerable variation in colour and marking from the normal types. These included the following species:

Chortobius Typhon, Rott.—Linwood; a very dark variety.

Thecla W-album, Knoch.—Sandbank; apparently new to Clydesdale.

Euchelia jacobeæ, L.—Bridge of Weir; new to the locality.

Arctia fuliginosa, L.—Top of hills above Colintraive; a very peculiar variety having the fore-wings perfectly clear and transparent like those of the *Sesiidæ*.

Bombyx rubi, L.—Sandbank; a very peculiarly coloured form, clouded with rich pink.

Notodonta chaonia, Hub.—Bred from a larva taken in the Johnstone district.

Tethea subtusa, Fab.—Bred from a larva taken at Sandbank,
Hadena protea, W.V.—Johnstone.

Plusia bractea, W.V.—On honeysuckle in the Johnstone district.

Sarothripus undulanus, Hub.—Sandbank; on oak.

Halias prasinana, L.—Johnstone; a remarkable variety shown.

Hybernia progemmaria, Hub.—Johnstone; a series of females showing remarkable variation in colour, some being almost black.

Geometra vernaria, Hub.—Kyles of Bute; apparently new to the district.

Thera variata, Schiff.—Johnstone; four very dark varieties. This insect is double-brooded in Clydesdale, those emerging in autumn being much smaller in size and darker in colour. Entirely black specimens have been taken by Mr. Watson on several occasions.

Emmelesia alchemillata, L.—Johnstone.

E. unifasciata, Haw.—Rare in Clydesdale; a remarkable form, having one broad white band in place of the double rivulet-line.

Oporabia dilutata, Bork.—Johnstone; a very dark variety.

Cheimatobia brumata, L.—Near Johnstone; a beautifully banded form.

Eupithecia pygmæata, Hub.—Johnstone; a very dark form.

Peronea hastiana, L.—Johnstone district.

P. rufana, Schiff., var. *autumnana*.—Sandbank.

Pœdisca rubiginosana, H.-S.—Sandbank; new to Clydesdale.

Coccyx cosmophorana, Fr.—Bridge of Weir; new to Clydesdale.

C. pygmæana, Hub.—Very rare; new to Clydesdale.

Retinia turionana, Hub.—New to Clydesdale,

Stigmonota coniferana, Retz.—Johnstone.

Dioryctria abietella, Zinck.—Linwood district; very rare.

Cedestis gysselinella, Dup.—New to Clydesdale.

Mr. D. A. Boyd stated that he had taken a specimen of *Euchelia jacobeæ*, L., at Seamill, West Kilbride, about fifteen years ago.

Mr. James J. F. X. King exhibited several species of *Lepidoptera* showing considerable variation from the typical forms. Among these were included the following:

Oporabia dilutata, Bork.—Two very striking forms, taken in Renfrewshire. These were remarkable for the obliteration of the usual markings, which were replaced by dark basal and anal bands, leaving a light central fascia equal in breadth to fully two-fifths of the wings.

Thera variata, Schiff.—Bridge of Weir. In the example shown the dorsal part of the central fascia was awanting.

Melanippe montana, Bork.—Taken near Glasgow by Mr. T. J. Henderson about twenty years ago. Dorsal part of the central fascia awanting.

Mr. A. Somerville, B.Sc., F.L.S., exhibited specimens of *Orobanche rubra*, Sm., from the Island of Eigg, where he had found it growing in some plenty as a parasite on *Thymus*

Serpyllum. In the course of some interesting remarks, Mr. Somerville contrasted the parasitic plants of this genus, which are almost leafless and destitute of chlorophyll, with the Mistletoe, which possesses chlorophyll in its leaves, and may therefore be regarded as only partially subsisting on its host. He also contrasted the Broom-rapes with the saprophytes, another group of plants almost destitute of chlorophyll, but deriving their nutriment from decaying vegetable matter and not parasitic on living plants. It is interesting to observe that the numerous parasites and saprophytes, which are characterized by the absence of chlorophyll in their tissues, are not confined to any one order, but are found in genera widely separated. They all agree, however, in possessing a tubular or gamopetalous flower.

Mr. Somerville also exhibited specimens of *Scutellaria minor*, L., from the shores of Loch Aylort, Inverness-shire, and *Malaxis paludosa*, Sw., from Loch Maree, Ross-shire; and after describing the characteristic features of these plants, he enumerated the various Scottish stations from whence they have been reported.

Mr. R. Turner, V.P., showed a series of specimens of the British *Orobanches*; also specimens of *Hedysarum coronarium*, L., from the neighbourhood of Fiume, where the plant is extensively cultivated for fodder. It is frequently found among hay imported from the Continent.

Mr. David Gregorson, F.E.I.S., exhibited specimens of the following *Algæ* from localities in the West of Scotland:

Fucus ceranoides.—Kyles of Bute.
Laminaria phyllitis —Helensburgh.
L. fascia.—Kyles of Bute.
Chorda lomentaria.—Kyles of Bute.—
Chordaria flagelliformis.—Kyles of Bute.
Rhodomela lycopodioides.—Helensburgh.
Polysiphonia fastigiata.—Kyles of Bute.
Laurencia cæspitosa.—Kyles of Bute.
Lomentaria kaliformis.—Kyles of Bute.
Maugeria sanguinea.—Helensburgh.
Rhodymenia palmata.—Helensburgh.
Cystoclonium purpurascens.—Kyles of Bute.
Chylocladia clavellosa —Helensburgh.
Ceramium botryocarpum.—Kildonan.
Callithamnion spongiosum.— Kildonan.
Porphyra vulgaris.—Helensburgh.
P. laciniata.—Helensburgh.
Ulva linza.—Kyles of Bute.
U. latissima.—Kyles of Bute.

Mr. R. Turner, V.P., exhibited a portrait (in oil) of Thomas Hopkirk of Dalbeth, LL.D., F.L.S., author of the *Flora*

Glottiana, *Flora Anomoia*, &c., and founder of the Glasgow Royal Botanic Garden.*

The following papers were read:—"On some *Hymenoptera* (chiefly undescribed) from Japan and the Pacific," by Mr. P. Cameron;† "A new species of *Allantus* (*A. breviventris*, sp. n.) from Salonica," by Mr. P. Cameron;‡ "Notes on the Land and Fresh-Water *Mollusca* of Greenock and the surrounding district," by Mr. Thomas Scott, Corresponding Member.§ All the papers were illustrated with examples of the various species described or referred to, Mr. Scott's being accompanied by a complete collection.

26TH JANUARY, 1886.

Mr. R. Turner, Vice-President, in the Chair.

The Chairman referred to the movement for providing a Memorial for the late Mr. Roger Hennedy, and stated that the Committee had arranged that the Memorial should take the form of a marble bust to be placed in Anderson's College, where Mr. Hennedy so long occupied the post of Lecturer on Botany. Mr. Turner expressed the hope that the Members of the Society would liberally respond to the invitation that had been made for aid in carrying the movement to a successful termination

The Chairman exhibited Flowers and Cones of the American Spruce Pine (*Pinus variabilis*), from Georgia, U.S.A.; also stereoscopic views of woodland scenery in the same State, showing the extraordinary profusion of *Tillandsia* which hangs from the trees in the form of great matted festoons.

The Secretary (Mr. D. A. Boyd) exhibited specimens of *Polygonum maritimum*, L., recently gathered at Braunton, North Devon, by Mr. W. B. Waterfall, Bristol; and he referred to the characteristic features of the plant, and the area of its distribution.

Mr. A. Somerville, B.Sc., F.L.S., presented to the Society a copy of a new List of British Marine Shells, compiled by him with the assistance of several eminent conchologists. After some interesting remarks on the different types of shells borne by various species in each of the seven great divisions of the animal kingdom, Mr. Somerville stated that when studying the marine *Mollusca* he had frequently felt the want of a list which would be of use as a collection-catalogue, dredging-record, and medium for marking exchanges. As no other convenient List of the kind was in existence, he hoped that the one now published would be found useful by other workers in Marine

* *Transactions*, i. 259; Plate II.
† *Id.*, i. 263. ‡ *Id.*, i. 277. § *Id.*, i. 279.

Conchology. On the motion of the Chairman a vote of thanks was awarded to Mr. Somerville for his gift.

Mr. David Robertson, F.L.S., F.G.S., sent for exhibition a specimen of the Heart Urchin, *Amphidotus cordatus*, Penn., a common species on the sandy shores of the Firth of Clyde; and, in a short paper, he communicated the result of experiments made by him with the view of determining the seat of secretion of the mucus which the animal possesses the power of discharging. *

Mr. Somerville made some remarks on the *Echinoidea* or Sea-Urchins, and gave an account of the morphology of the various British genera, pointing out the distinguishing features on which their classification is based. These he illustrated by means of coloured diagrams, showing on an enlarged scale the structure of the typical species.

Mr. Thomas King read an interesting paper on "The Origin of our Food-Plants."

23RD FEBRUARY, 1886.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. Thomas Scott, Corresponding Member, sent for exhibition a glass jar containing sea-water in which many of the free larvæ of *Balanus balanoides* could be seen moving rapidly about.

Mr. Scott also sent specimens of *Leptaspidea brevipes*, Bate and Westwood, an Isopod of which three examples were obtained by him in 1884, among material dredged from a depth of about ten fathoms, muddy bottom, in the Clyde near Fort Matilda, Greenock. All that can apparently be learned regarding the distribution of this species, is as follows: "We are only acquainted with a single individual of the single species upon which we have established this genus,—two or three specimens having been taken by Mr. Robertson at Cumbrae to whom we are indebted for it." † The length is stated by Bate and Westwood to be "one twentieth of an inch," but one of the specimens taken by Mr. Scott rather exceeded that measurement. ‡

Mr. Scott also sent specimens of an apparently undescribed species of *Anceus*, three or four of which were obtained in the same locality and about the same time as the *Leptaspidea brevipes* above referred to. He had at first been inclined to refer these to *A. maxillaris*; but, on examination, the mandibles were found to differ materially from those of that species, and of all the species described in Bate and Westwood's *British Sessile-eyed Crustacea*. They rather resembled

* *Transactions*, i. 290.

† Bate and Westwood, *British Sessile-eyed Crustacea*, vol. ii., p. 333.

‡ This species has since been found by Mr. Scott to be of frequent occurrence both in Lochfyne and in Rothesay Bay.

those of the *Anceus* obtained in East Loch Tarbert, for which Mr. Scott had proposed *Normani* as a specific name.* The pereion, however, showed a decided constriction near the middle, whereas the pereion of the Tarbert specimen was of nearly equal breadth throughout. The pleon also differed in form from that of the Tarbert specimen, and more nearly resembled that of *A. maxillaris*. He was therefore not in a position at present to refer this form to any described species.†

Mr. James Steel exhibited specimens of *Limnæa palustris*, Müll., received from Mr. Marshall Reid, New Brunswick, a Member of the Society. In the course of some remarks, Mr. Steel stated that the species, which is very common in this country, has an almost world-wide distribution; and he drew attention to the fact that shells from New Brunswick did not differ materially, either in size, colour, or thickness, from those obtained in this country.

Mr. A. Somerville, B.Sc., F.L.S., exhibited a sinistral specimen of *Limnæa peregra*, Müll., from Surrey; a dextral specimen of *Clausilia rugosa*, Drap., taken in Stirlingshire, and kindly lent by Mrs. Skilton, Brentford, Middlesex, for exhibition to the Society; also various other recent and fossil reversed Gastropod shells. He made some interesting remarks on the occurrence of these abnormal forms in various genera, and referred to the theories which have been advanced to explain their origin.

Mr. Peter Ewing exhibited specimens of some Alpine Plants from Forfarshire, Aberdeenshire, &c.‡ These included the following species:

Thlaspi alpestre, L., var. *sylvestre*, Jord.—Canlochan.
Cerastium trigynum, Vill.—Lochnagar.
Saxifraga rivularis, L.—Lochnagar.
Gnaphalium norvegicum, Gunn.—Lochnagar.
Mulgedium alpinum, Less.—Lochnagar.
Epipactis ovalis, Bab.—N.E. Perthshire.
Carex lagopina, Wahl.—Lochnagar.
Alopecurus alpinus, L., var. *Watsoni*.—Canlochan.
Lycopodium annotinum, L.—N.E. Perthshire.

Mr. Ewing also showed a specimen of *Schœnus ferrugineus*, L., a recent addition to the British Flora, discovered at Tummelbridge, Perthshire, by Mr. James Brebner, Dundee.

The Chairman (Dr. Stirton) showed specimens of *Carex salina*, Wahl., var. *kattegatensis*, a recent addition to the British Flora, discovered by Mr. James Grant in the Wick Burn, Caithness.

Mr. A. Somerville, B.Sc., F.L.S., exhibited a small type of

* *Transactions*, i. 374.

† After further examination, Mr. Scott has referred the Greenock specimens to the species obtained at Tarbert.

‡ *Transactions*, i. 286.

Dredge, with complete dredging apparatus; and after describing its construction and use, he presented it to the Society. A cordial vote of thanks was awarded Mr. Somerville for his valuable gift.

Mr. W. Craibe Angus exhibited a male example of the Pine Marten *(Martes foina)* from the Blackmount Forest; a male Smew *(Mergus albellus)* in beautiful plumage, shot on the Lea by Mr. H. Crum Ewing; a Velvet Scoter *(Oidemia fusca)*; a curiously marked example of the common Partridge *(Perdix cinerea)* from Argyllshire; and Scotch examples of the Shore Lark *(Alauda alpestris)* and Pintail Duck *(Dafila acuta)* in the flesh.* Mr. Angus made some remarks on the occurrence of the various species in the British Isles.

The Secretary (Mr. D. A. Boyd) laid on the table a Collection of Mosses of the genus *Sphagnum*, presented to the Society by Mr. James M'Andrew, Corresponding Member. The Collection, which comprised 149 packets of specimens, included the following species, with most of their recognised varieties, and a number of the more remarkable forms presented by these extremely variable plants:

Sphagnum acutifolium,	53	*Sphagnum rigidum*,	8
fimbriatum,	2	*subsecundum*,	19
strictum,	3	*laricinum*,	2
squarrosum,	2	*tenellum*,	2
teres,	2	*Austini*,	13
intermedium,	6	*papillosum*,	7
cuspidatum,	15	*cymbifolium*,	12
molle,	3		

Mr. Boyd stated that the Council had resolved that the valuable specimens presented by Mr. M'Andrew should form the nucleus of a general collection of British Mosses, to be mounted in the form of fasciculi and placed in the Library for reference by the Members. Such a collection, when completed, would doubtless prove of much assistance to students of Bryology.

On the motion of the Chairman, a cordial vote of thanks was awarded to Mr. M'Andrew for his valuable gift.

Mr. Dougall sent for exhibition some Micro-photographs of *Aulacodiscus formosus*, the tongue of the Blow-fly, and other objects, photographed by Mr. John Milton Offord, M.R.M.S. In these the minute details of the objects were reproduced with great clearness and beauty.

The following papers were read: "Natural History Notes from Tarbert," by Mr. Thomas Scott, Corresponding Member;† "On some Forms of *Sphagna* found in the Glenkens, Kirkcudbrightshire," by Mr. James M'Andrew, Corresponding Member.‡ Both papers were illustrated with specimens of all the species therein referred to.

* *Transactions*, i. 379, 382 † *Id.*, i. 369. ‡ *Id.* i 366.

30TH MARCH, 1886.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. James Robertson, 5 Mauldslie Place, Partick, was elected an Ordinary Member.

Mr. W. Craibe Angus exhibited two Hybrids between the Blackcock and Capercaillie, on which he made some remarks.* He also showed an example of the Great Crested Grebe, *Podiceps cristatus*, L., in fine plumage, and read some notes descriptive of the species and its habits.†

Rev. James E. Somerville, B.D., Corresponding Member, exhibited some beautiful examples of the Shells of South African *Bulimi* and *Achatinæ*, and made some interesting remarks on the habits and distribution of these genera of *Mollusca*.

Mr. D. A. Boyd exhibited specimens of the following Mosses:

Didymodon cylindricus, Bruch.—Moist rocks, Loch Ard, Perthshire; barren.

Barbula papillosa, Wils.—On the trunk of a tree, Loch Ard, Perthshire; barren.

Fissidens incurvus, W. and M.—Moist shady banks near Seamill, West Kilbride; in fruit.

Bryum roseum, Schreb.—On a shady bank, Biglees Glen, West Kilbride; barren.

Brachythecium albicans, Neck.—Sandy ground, Chapelton, West Kilbride; in fine fruit.

Hypnum resupinatum, Wils.—On walls and trees, Seamill, West Kilbride; in fruit.

The Chairman (Dr. Stirton) made some remarks on the reproduction of certain Mosses which have never been found with capsules. In most of such species the usual reproductive organs—antheridia and archegonia—are absent; but a compensating principle is afforded by little clusters of roundish bodies known as *propagula*, usually found at the tips of the leaves, which are capable of independent growth when detached from the parent plant.

Mr. Rochfort Connor, Greenock, exhibited some Micro-photographs in the form of Lantern-slides, illustrative of the *Diatomaceæ*, *Polycistina*, and interesting phases of Pond-life. He also showed a series of beautifully executed pen-and-ink drawings of vegetable structures as revealed by the microscope, and referred to the aid which that instrument affords for the detection of foreign substances in flour, pepper, tea, coffee, &c. Such substances are not usually distinguishable by the naked eye, but can at once be observed by the microscopist.

The following papers were read: "*Scaphander lignarius*, L.,"

* *Transactions*, i. 380. † *Id.*, i. 385.

by Mr. David Robertson, F.L.S., F.G.S.;* "*Gonometa postica*, Walker," by Rev. James E. Somerville, B.D., Corresponding Member,† with specimens of the Cocoons, Pupæ, and Moth, from Caffraria; "Meteorological Notes for 1885, with Remarks on the State of Vegetation in the Public Parks of Glasgow," by Mr. Duncan M'Lellan, Superintendent of Parks;‡ "Pollen," by Mr. R. Turner, Vice-President, with diagrams showing the structure of Pollen, and the beautiful forms of the grains in various orders of plants.

27TH APRIL, 1886.

Dr. James Stirton, F.L.S., President, in the Chair.

Reference was made to the death of Mr. Thomas Edward, A.L.S., Banff, one of the Corresponding Members, and of Mr. James Coutts, who for many years was connected with the Society.

IN MEMORIAM.

THOMAS EDWARD was born on 25th December, 1814, at Gosport, where his father was stationed with the Fifeshire militia during the absence of the regular troops in the Peninsular war. His father was a native of Fife, and his mother of Aberdeen. On the return of the militia, his father settled for a short time at Kettle, Fifeshire, but soon afterwards removed to Aberdeen, where he carried on his trade of a linen-weaver.

At a very early age young Edward manifested a strong taste for Natural History; and the waste-ground, tidal-flats, and muddy pools by the river-side, afforded him an attractive hunting-ground for insects, leeches, &c. These prizes were carried home; but the escape of the "uncanny beasts" led to perpetual domestic trouble, and the boy was sternly forbidden to engage in his uncouth pursuits. The love of Nature, however, could not be repressed, and threats and frequent punishment alike proved unavailing. Every spare moment was devoted to hunting by the river side, and the hours of school were too often spent in the same manner. As he was fond of carrying his strange treasures about with him, even when attending school, their frequent escape gave rise to a series of mishaps, by which his school-life was embittered, and himself regarded as an incorrigible nuisance. Accordingly, at the early age of six years, he had gained the unenviable reputation of having been dismissed in disgrace from three schools.

He was then sent to work, in the hope that active employment might cure him of his erratic tastes. After two years spent in a tobacco-spinner's workshop, at a wage of from 1s. 2d. to 1s. 6d. per week, he obtained more remunerative employment

* *Transactions*, i. 293. † *Id.*, i. 312. ‡ *Id.*, i. 305.

in the Grandholm mills, near Aberdeen, where he remained for about two years. These years he regarded as one of the most happy periods of his life. After his long day's work was done, he was accustomed to explore the country for miles along Donside, examining with delight every living creature he could capture.

At the age of eleven, he was bound for six years as apprentice to an Aberdeen shoemaker named Beggs. Although a good workman, Beggs was a man of dissipated habits and cruel disposition; and his strong dislike to Edward's pursuits induced him to adopt towards the lad a strongly repressive and heartless line of conduct. Stung by the cruelty and insult to which he was exposed, Edward refused to continue in his service, and no threats of legal proceedings for the breach of contract could induce him to return to work.

After an unsuccessful attempt to get away as a cabin-boy, he resumed work under a more considerate master. The difficulty of obtaining adequate employment led him, at the age of seventeen, to make an unsuccessful attempt to get to America as a "stowaway." After having enlisted in the Aberdeenshire militia, he settled in Banff about 1834. Three years later he married, although only in the receipt of a wage of about 9s. 6d. per week.

His Natural History collection had meanwhile been rapidly increasing, and in 1845 he exhibited it publicly in Banff. Having obtained a small sum by the venture, he repeated the experiment next year with still more satisfactory results; and believing that further success would attend him in Aberdeen, he rented a shop in Union Street, and removed his collection thither. The venture proved an utter failure. In a fit of despair, induced by the prospect of impending ruin, he resolved to drown himself, and went to the mouth of the Don to carry out his fatal resolution. When on the sands his attention was arrested by a bird of a species unknown to him: and under the stimulus of reviving interest, the dark cloud passed for ever from his mind. Having sold his collection for £20 10s., he once more removed to Banff, where he resumed his old business of shoemaking, and commenced to form a new collection.

By a fall from a cliff at Tarlair, he sustained severe injuries, which rendered him unfit to work for several weeks, and forced him to sell a portion of his new collection to obtain the means of support for himself and family during this period. Acting on the advice of the Rev. James Smith, Monquhitter, who had been impressed with Edward's capacity for original research, he commenced to send to the local newspapers an account of his experiences. In 1851, Mr. Smith communicated to the *Zoologist* a notice of some birds shot by Edward; and articles were afterwards contributed by the latter to the *Zoologist*, *Naturalist*, and other scientific journals.

In 1858, an attack of rheumatic fever forced him again to sell part of his collection. He then abandoned the idea of forming another collection, but turned his attention to the Banff Museum, which he enriched with many valuable additions. In Marine Zoology, to which his leisure hours were about this time devoted, he succeeded in finding many interesting species; and these discoveries brought him into correspondence with Messrs. Couch, Spence Bate, Norman, and many other distinguished naturalists, who have in their works made frequent acknowledgment of information and specimens obtained from him, and have named several species in recognition of his attainments.

He was elected an Associate of the Linnean Society in 1866, and a correspondent of numerous provincial societies. On 26th March, 1867, he was elected a Corresponding Member of this Society.

In 1868, his health, undermined by exposure and unremitting work, became seriously impaired, and for a time his attention was directed to antiquarian pursuits. A large "kitchen midden," discovered by him at Boyndie, yielded many interesting and remarkable relics.

The publication of his biography by Dr. Smiles in 1876,* led to a favourable change in his circumstances. In addition to the receipt of a life-pension of £50. and numerous sums of money sent by readers of the biography, he was in the following year presented with £333 in Aberdeen. On resigning the curatorship of the Banff Museum, with which he had been connected for thirty years, he was presented with a piece of plate in recognition of his services to that institution.

During his later years he turned his attention to Botany, and was successful in discovering many rare and local plants.

He died on 27th April, 1886, leaving a family of one son and ten daughters, eight of whom have been married.

The well-known incidents of his eventful life, as graphically narrated by his biographer, afford a remarkable instance of a stedfast devotion to Science amid the most unfavourable external circumstances; and they show that the pursuits of Nature are as freely open to the humble as to those whose lot has fallen in the privileged spheres of rank and culture.

James Coutts was one of the members of the Glasgow Naturalists' Society, of which he was Treasurer at the date of its amalgamation with the Natural History Society of Glasgow, 24th April, 1866.

During the period of his membership, which extended over seventeen years, he took an active part in the work of the Society, and frequently contributed to the business of the meetings. He was on several occasions elected a Member of Council.

* Dr. S. Smiles, *The Life of a Scottish Naturalist.*

His enthusiasm, as a naturalist, served to stimulate other workers; and his willingness to afford to others that assistance which his extensive knowledge of Natural History enabled him to bestow, secured for him the esteem of his fellow-members in the Society.

It is interesting to notice that his last appearance at the meetings of the Society was on 25th September, 1883, when he read a memorial notice of his friend, Mr. George J. Combe, also a former member of the Glasgow Naturalists' Society.

The following were elected Ordinary Members: Messrs. Robert Maconechy, 64 St. Vincent Street; James Campbell, 1 Florentine Place, Hillhead; J. Steel Muir, M.D., Saracen Cross, Possilpark; George Butler, 189 Pitt Street; and Frank Griffin, Glasgow School of Art.

The Secretary (Mr. D. A. Boyd) read a letter from Dr. Alexander Hamilton Howe, of Hullerhirst, Stevenston, one of the Members of the Society, intimating a donation to the Library of a copy of Mr. George Gardner's *Travels in the Interior of Brazil*. The book was especially interesting and valuable as the copy presented by the author to Sir Colin Campbell, afterwards Lord Clyde. A cordial vote of thanks was awarded to Dr. Howe for his kind gift.

Mr. James Steel exhibited a collection of Gastropod Shells from South Africa, including *Latiaris Bairstowii*, Sowerby, and *Crepidula lentiginosa*, Sowerby, two recently described species; also a number of living specimens of Land-Shells from Spain, Italy, and South Africa, which had survived the dangers of transit and were apparently in a healthy condition.

Mr. James J. F. X. King exhibited a specimen of *Anchomenus Sahlbergi*, Chaud., a Beetle new to the European Fauna. This, and several other examples of the same insect, had been taken on the banks of the River Clyde near Bowling, about thirty years ago, by Mr. Thomas G. Bishop, one of the Members of the Society; but only recently the Beetles were discovered to belong to the species named.

Mr. King also showed specimens of *Capnia nigra*, Pict., from Loch Earn (Perthshire), and Insh (Inverness-shire), and several of the rarer *Perlidæ* from these and other districts.

Mr. D. A. Boyd made some remarks on the Moss-Flora of the Calder Valley between Lochwinnoch and Muirshiel. The River Calder rises on a stretch of high moorland, between Largs and Port-Glasgow, and receives numerous small tributary streams which descend from Hill of Stake (1711 feet), Misty Law (1663 feet), and other hills of that range. In its descent, the river passes through numerous moist rocky gorges; and the lower part of its course, known as the "Calder Glen," is picturesquely wooded. This district, which was recently visited

by Messrs. T. King, Richard M'Kay, and Boyd, was found to be very rich in Mosses, several alpine species—such as *Zieria julacea*—growing with a luxuriance rarely to be observed in lowland stations.

Mr. Boyd exhibited specimens of the following Mosses from the various localities mentioned, on which he made some remarks, viz.:

Andreæa Rothii, W. and M., var. *falcata*, Schpr.—Knock Jergon, Ardrossan; in fruit.

Gymnostomum rupestre, Schwg.—Calder Valley; in fruit.

Rhabdoweissia fugax, Hedw.—Calder Valley; in fruit.

Anectangium compactum, Schl.—Calder Valley; barren.

Blindia acuta, Hedw.—Calder Valley; with old capsules and immature fruit.

Didymodon cylindricus, Bruch.—Calder Valley; barren.

Grimmia Donniana, Sm.—Clober Moor, near Milngavie; in fruit.

Zieria julacea, Schpr. — Calder Valley; in large luxuriant masses, covered with capsules.

Mnium cuspidatum, Hedw.—Grassy places on sand, near Fencebay, West Kilbride; in fruit.

M. subglobosum, B. and S.—Knockewart Loch, Ardrossan; luxuriant, and in fine fruit.

Heterocladium heteropterum, Bruch.—Rocks on the Allander at Clober Moor; Birkhead Glen, Dalry; barren.

Hyocomium flagellare, Dicks.—Calder Valley; barren.

Plagiothecium pulchellum, Hedw.—Calder Valley; in fruit.

Mr. Peter Ewing showed a fine collection of the British *Sphagna*, including all the forms enumerated in the second edition of *The London Catalogue of British Mosses*, with the exception of two varieties — *Sphagnum acutifolium*, Ehrh., var. *gracile*, and *S. strictum*, Lindb., var. *squarrosulum*- which are now regarded as doubtful natives.

Mr. Thomas King exhibited a specimen of *Anemone ranunculoides*, L., from Suffolk.

Dr. John Grieve, F.R.S.E., F.L.S., exhibited a specimen of *Astrantia helleborifolia*, Willd., a native of Siberia, said to be grown occasionally in cottage gardens. The specimen shown was found in July, 1885, by Rev. Dr. Ross, Bridge of Allan, in Wamphray Glen, near Moffat—a spot remote from any garden or dwelling from whence the seed might have escaped.

The following papers were read: "On the Pagoda Stone of the Chinese (*Orthoceras*, sp.)," with two illustrative specimens, by Dr. John Grieve, M.A., F.R.S.E., F.L.S.;* "The Skua, *Lestris cataractes*, L.," by Mr. W. Craibe Angus;† "Notes on the *Neuroptera* of Rothiemurchus and Kingussie," by Mr. James J. F. X. King.‡

* *Transactions*, i. 394. † *Id.*, i. 390. ‡ *Id.*, i. 354.

ABSTRACT STATEMENT OF ACCOUNTS.—Session 1884-85.

To Balance in Bank and in Librarian's hands,			£55	11	7½		
Less due to Treasurer,			5	13	7		
						£49	18	0½
To 1 Life Member's Subscription,						5	5	0
,, 189 Annual Members' Subscriptions @ 7s. 6d.,						70	17	6
,, 1 ,, ,, ,, 5s.,						0	5	0
,, 16 New Members' Entry-Money @ 7s. 6d.,						6	0	0
,, 11 Members' Arrears,						4	0	0
,, Bank Interest,						1	9	8
,, *Proceedings*, &c., sold, per Librarian,						3	16	7½
,, Subscriptions received for printing *Proceedings*,						9	10	0
						£151	1	10

By Rent and Attendance,	£3	6	0
,, Postages, Stationery, &c.,	9	17	2½
,, Printing *Proceedings*, Circulars, &c.,	29	12	6
,, Library—Additions,	3	12	3½
,, ,, Binding,	5	0	0
,, ,, Postages, Carriage, &c.,	6	17	3
,, ,, New Book-cases,	18	3	0
,, Balance in Bank, and in hands of Treasurer and Librarian,	74	13	7
	£151	1	10

20th October, 1886.—We have this day examined the Books, compared the Vouchers, and found the whole correct, the Balance in Bank and in hands in October, 1885, amounting to Seventy-four pounds, thirteen shillings, and seven pence.

WILLIAM STEWART.
JOHN RHIND.

LIST OF SOCIETIES, &c., WITH WHICH PUBLICATIONS ARE EXCHANGED.

Alnwick.—Berwickshire Naturalists' Field Club.
Amsterdam.—Koninklijke Akademie van Wettenschappen.
Barrow.—Naturalists' Field Club.
Basel.—Naturforschende Gesellschaft.
Bath.—Natural History and Antiquarian Field Club.
Belfast.—Naturalists' Field Club.
Natural History and Philosophical Society.
Birmingham.—Philosophical Society.
Bonn.—Naturhistorischer Verein der Preussischen Rheinlande und Westfalens.
Bordeaux.—Société Linnéenne.
Boston.—Society of Natural History.
Braunschweig.—Verein für Naturwissenschaft.
Bremen.—Naturwissenschaftlicher Verein.
Brighton.—Brighton and Sussex Natural History Society.
Bristol.—Naturalists' Society.
Brünn.—Naturforschender Verein.
Brussels.—Société Entomologique de Belgique.
Société Malacologique de Belgique.
Société Royale de Botanique de Belgique.
Budapest.—Királyi Magyar Természettudományi Társulat.
Cambridge, Mass.—Entomological Club.
Museum of Comparative Zoology.
Nuttall Ornithological Club.
Cardiff.—Naturalists' Society.
Cassel.—Verein für Naturkunde.
Cherbourg.—Société Nationale des Sciences Naturelles et Mathématiques.
Chester.—Society of Natural Science.
Christiania.—Royal University of Norway.
Cincinnati.—Society of Natural History.

Cordoba.—Academia Nacionale de Ciencias.
Danzig.—Naturforschende Gesellschaft.
Devonport.—Academy of Natural Sciences.
Dresden.—Naturwissenschaftliche Gesellschaft "Isis."
Dublin.—Royal Dublin Society.
Dumfries.—Dumfriesshire and Galloway Natural History and Antiquarian Society.
Dundee.—East of Scotland Union of Naturalists' Societies.
Durham.—Tyneside Naturalists' Field Club.
Eastbourne.—Natural History Society.
Edinburgh.—Botanical Society.
Geological Society.
Naturalists' Field Club.
Royal Physical Society.
Scottish Geographical Society.
Elberfeld.—Naturwissenschaftlicher Verein.
Essex.—Epping Forest and Essex Naturalists' Field Club.
Florence.—Societá Entomologica Italiana.
Frankfurt.—Senckenbergische Naturforschende Gesellschaft.
Gent.—Natuurwetenschappen.
Glasgow.—Archæological Society.
Faculty of Physicians.
Geological Society.
Industrial Museum.
Mitchell Library.
Philosophical Society.
Stirling's Library.
Giessen.—Oberhessiche Gesellschaft für Natur und Heilkunde.
Gorlitz.—Naturforschende Gesellschaft.
Granville—Denison University.
Graz.—Naturwissenschaftlicher Verein für Steiermark.
Griefswald.—Naturwissenschaftliche Vereine von Neu-Vorpommern und Rügen.
Halifax.—Nova Scotian Institute of Natural Science.
Hallé.—Leopoldina Carol.
Halle.—Naturforschende Gesellschaft.
Hamburg.—Naturwissenschaftlicher Verein für Hamburg-Altona.
Heidelberg.—Naturhistorisch-medicinischer Verein.
Helsingfors.—Societas pro Fauna et Flora Fennica.
Kiew.—Société des Naturalistes.

Königsberg.—Physikalische-ökonomische Gesellschaft.
Landshut.—Botanical Society.
Leeds.—Naturalists' Club and Scientific Association.
Yorkshire Naturalists' Union.
Leipzig.—Naturforschende Gesellschaft.
Liége.—Société Royale des Sciences.
Liverpool.—Naturalists' Field Club.
London.—British Association, Corresponding Societies' Committee.
British Museum Library.
Editors Entomologists' Monthly Magazine.
Entomological Society.
Royal Geographical Society.
Geologists' Association.
Linnean Society.
Quekett Microscopical Club.
Royal Microscopical Society.
London, Ontario.—Entomological Society of the Province of Ontario.
Lyon.—Société Linnéenne.
Madrid.—Sociedad Española de Historia Natural.
Metz.—Société d'Histoire Naturelle.
Manchester.—Field Naturalists' and Archæologists' Society.
Geological Society.
Literary and Philosophical Society.
Scientific Students' Association.
Meriden, Conn.—Scientific Association.
Moscow.—Société Impériale des Naturalistes.
Münster.—Westfälischer Provinzial-Verein für Wissenschaft und Kunst.
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THE

FAUNA OF SCOTLAND;

WITH SPECIAL REFERENCE TO

CLYDESDALE

AND THE

WESTERN DISTRICT.

HYMENOPTERA.

PART II.

BY

PETER CAMERON.

GLASGOW:
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THE FAUNA OF SCOTLAND,

WITH SPECIAL REFERENCE TO CLYDESDALE AND THE WESTERN DISTRICT.

HYMENOPTERA.—Part II.

SUPPLEMENT TO TENTHREDINIDAE.

During the six years which have elapsed since the appearance of the first part of this work, I have been able to make considerable additions to our knowledge of the Scottish species of *Tenthredinidae*,—the total number of species being increased from 209 to 268, and the Clydesdale species from 146 to 178. The chief additions have been in *Tenthredopsis*, *Dolerus*, and *Nematus*, while one genus *(Fenella)* has been added. These additions are principally from the Western district, which has now a greater number of species recorded from it than the Eastern; but as the Western district has been better explored than the Eastern, it would be premature to conclude from our present information that the Western is the richer of the two in species.

Our present knowledge shows that Scotland has, roughly, about two-thirds of the total British species, and 47 less than England. A comparison of the table on p. 63 will show that the latter country is much richer in species of *Macrophya*, *Allantus*, *Dolerus*, *Hylotoma*, and *Cephus*, all (with possibly the exception of *Dolerus*) more particularly Southern genera. The great scarcity of species of *Cephus* in Scotland is very remarkable.

Our knowledge of the distribution of Sawflies in Britain is so meagre that it would be idle to draw any conclusion from the data I have tabulated. I believe, however, that I shall not be far wrong if I express the belief that an increase of workers in England and Scotland will show that many species now known only from one country are common to both; that some species of wide European distribution, but

rare and local in their habitats, are not likely to occur in both countries from causes which we are unable to explain; that many species—boreal and alpine—are not likely to be found in England, judging from their Continental range; and lastly, that numerous species of Southern genera (*Macrophya*, &c.) may confidently be expected, if we may judge from their general distribution, not to extend northward beyond the Midland Counties of England.

I do not expect that further research will show much difference in the relative numbers of the species found inhabiting the two countries; for, if I mistake not, about two-thirds of the total British species is the proportion in other groups of insects found to inhabit Scotland.

In the catalogue the additional species only are numbered. I have indicated such changes as have been made in nomenclature, and have given new localities for the rarer species.

GENUS: TENTHREDO.

8.ª SCOTICA, *Cam.*

Rare. Dumfries.

T. ZONATA, *Pz.*

This name is changed to the earlier one of *maculata*, Fourc.

T. OBSOLETA.

Castlecary Glen.

T. VIRIDIS.

This is *picta*, Kl., as stated, but is not, I now believe, the true *viridis*, Lin., that being probably identical with *scalaris*, Kl., No. 13. *T. picta* I have found commonly at Thornhill.

TENTHREDOPSIS.

So many alterations and additions have to be made in this genus that it will be best to give a complete revision of it.

1. T. CORDATA, *Fourc.*

Common in Clydesdale and the West of Scotland.
Polmont, Kingussie.

2. T. MICROCEPHALA, *Lep.*

"Scotland," Stephens, Ill. Brit. Ent., vii., p. 78

3. T. FEMORALIS, *Ste.*

Dumfries, June.

4. T. CALIGINOSA, *Ste.*

Dumfries.

5. T. IGNOBILIS, *Cam.*

Rannoch.

6. T. NIGRICOLLIS, *Cam.*

Lochaweside.
Rannoch.

7. T. SCUTELLARIS, *Fab.*

Common.

8. T. FLAVOMACULATA, *Cam.*

Salen, in Mull.
Rannoch.

9. T. PICTICEPS, *Cam.*

The type of this species is Scotch, but I have not noted the exact locality.

10. T. TRISTIS, *Ste.*

Loch Awe.
Aberdeen *(Trail).*

11. T. LIVIDIVENTRIS, *Cam.*

Mugdock Wood, in June.

12. T. ALBOMACULATA, *Cam.*

Rare. Rannoch, in June.

13. T. NIGRICEPS, *Cam.*

Salen, in Mull. June.

14. T. DORSIVITTATA, *Cam.*

Kingussie.

15. T. INORNATA, *Cam.*

Bishopton.
Rannoch.

16. T. NASSATA, *Lin.*

Cadder, New Galloway, Loch Awe, Mull.
Rannoch.

17. T. SORDIDA, *Klug.*

Commonly distributed.

MACROPHYA.

Before No. 1 add—

M. RUSTICA, *Lin.*

Near Paisley *(Dunsmore)*.

M. ALBICINCTA.

Thornhill.

ALLANTUS.

A. NOTHUS.

This name is changed to the prior one of *arcuatus*, Forster.

SCROPTERYX.

S. COSTALIS.

Thornhill.

DOLERUS.

D. PRATENSIS, *Lin.*

I believe this is not identical with *eglanteriae*, Fab., as stated by Thomson, Hymen. Scand., i., p. 284. I have therefore adopted the name of *fulviventris*, Scop.

4.ª D. GESSNERI, *André.*

Lochaweside.

4.ᵇ D. SCOTICUS, *Cam.*

Braemar.

5.ª D. PUNCTICOLLIS, *Thoms.*

Near Paisley.

5.ᵇ D. LIOGASTER, *Thoms.*

Cadder, St. Germain's Loch, Strathblane. A specimen from Possil Marsh has the hind tibiae black, with a reddish ring below the base, which is black.

7.ª D. OBLONGUS, *Cam.*

Rannoch, Braemar.

7.ᵇ D. POSSILENSIS, *Cam.*

Possil Marsh.

7.ᶜ D. INTERMEDIUS, *Cam.*

Lochaweside, Dumfries.
Rannoch.

D. VARISPINA, *Htg.*

Mr. Hardy records this species for Berwickshire, but I know not if it be identical with the *varispina* of my Monograph. The specimen from Dr. Sharp is not the true *varispina*.

STRONGYLOGASTER.

Before *S. cingulatus* add—

S. SHARPI, *Cam.*

Crickhope Linn, Dumfriesshire.

2.ª S. MACULA, *Kl.*

Kilpatrick Hills.

POECILOSOMA.

3.ª P. LONGICORNE, *Thoms.*

Cadder, Strathblane, &c.

5. P. NIGRICOLLE, *Cam.*

Thornhill.

EMPHYTUS.

Before *E. cinctus* add—

E. TOGATUS, *Pz.*

Near Paisley *(Dunsmore)*.

COENONEURA.

C. DAHLBOMI, *Thoms.*

Thomson's generic and specific names must give way to the earlier *Heptamelus ochroleucus*, Haliday.

At p. 23, after *Fenusa* add—

FENELLA, *West.*

1. F. WESTWOODII, *Cam.*

Bishopton.

SELANDRIA.

S. GRANDIS, *Zad.*

An earlier name for this is *Sixii*, Vol.

Thornhill.

S. FLAVENS.

Lochlibo.

4.ª S. TEMPORALIS, *Thoms.*

Dumfries.

ERIOCAMPA.

E. ADUMBRATA, *Klug.*

=*limacina*, Retz.

5. E. ROSAE, *Harris.*

Dumfries, Cardross.

Cockburnspath *(Hardy).*

Probably a common (and destructive) insect in gardens.

BLENNOCAMPA.

B. MELANOCEPHALA, *Fab.*

Mugdock, Thornhill, Aberfoyle.

B. FULIGINOSA, *Schr.*

Dumfries.

HOPLOCAMPA.

Before No. 1 add—

H. FERRUGINEA, *Pz.*

Thornhill.

H. CRATAEGI.

This is *alpina*, Zett., perhaps identical with *pallida*, Newman (Ent. Mag. iv., p. 262).

DINEURA.

D. DEGEERI, *Kl.*

An earlier name for this species is *virididorsata*, Retz.

D. DESPECTA, *Kl.*

The species recorded as *Blennocampa fuscula*, Kl. (p. 26), is identical with *D. despecta*, Kl., and *Blennocampa parvula*, Thoms. Thomson places it in *Blennocampa*, from the typical species of which it differs in having two middle cellules in the posterior wings.

D. VERNA, *Kl.*

Thornhill.

D. STILATA, *Kl.*

Common at Cadder and in most localities on the Hawthorn.

CLADIUS.

C. VIMINALIS, *Fall.*

Milngavie.

C. DIFFORMIS, *Pz.*

Must now be called *C. pectinicornis*, Fourc., that being the first name under which it was described.

C. BRULLAEI, *Dbm.*

Kilpatrick Hills. Common.

NEMATUS

N. LUCIDUS, *Pz.*

Clober.

5.[a] N. GLENELGENSIS, *Cam.*

Glenelg.

N. FALLAX, *Lep.*

=*haemorrhoidalis*, Spin.

9.[a] N. TURGIDUS, *Zad.*

Cadder and Milngavie.

N. HYPERBOREUS.

I have come to the conclusion that this is not the *hyperboreus* of Thomson, and, not having been described anywhere, I have called it *N. Thomsoni.*

N. FURVESCENS.

I think this species is the same as *ambiguus*, Fall., *sec.* Thoms.

N. ALNIVORUS.

Further observation may show that this is only a large form of *fulvipes*, Fall.

20.[a] N. OBLONGUS, *Cam.*

Kilpatrick Hills. Rare.

N. FRAXINI.

=*ruficornis*, Olivier.

21.[a] N. FLETCHERI, *Cam.*

Mugdock.

N. LEUCOTROCHUS.

=*leucogaster*, Htg.

27.[b] N. SCOTICUS, *Cam.*

Braemar.

27.[b] N. PULCHELLUS, *Cam.*

Possil.

N. PALLIPES, *Fall.*

As I found that this species was evidently different from the true *pallipes*, I named it *breadalbanensis*. It is only found on our highest mountain tops.

Ben More, Mull.

28.[a] N. LATIVENTRIS, *Thoms.*

Braemar.

28.[b] N. ASTUTUS, *Cam.*

Braemar.

28.[b] N. PARVICORNIS, *Kirby.*

Learg, Sutherlandshire.

N. UMBRINUS.

=*consobrinus*, Vol.

Milngavie.

33.[a] N. MONTICOLA.

Rannoch.

35.[a] N. ANTENNATUS, *Cam.*

Altnaharra, Sutherlandshire.

35.[b] N. CALEDONICUS, *Cam.*

Lochaweside.

36.[a] N. ACUMINATUS, *Thoms.*

Common.

This was confounded with *N. dorsatus*, which is only known from Bishopton.

37.[a] N. COLLINUS, *Cam.*

Kingussie, Lochaweside at Cladich.

33.[b] N. CONJUGATUS, *Dbm.*

Milngavie.

44.[a] N. GLOTTIANUS, *Cam.*

Near Devol's Glen.

N. CADDERENSIS.

Possil Marsh. The larvae feeding on *Salix pentandra*.

45.[a] N. SALICIVORUS, *Cam.*

Mugdock, Cadder.

45.[b] N. GLUTINOSAE, *Cam.*

Common on Alder.

46.[a] N. BERGMANNI, Dbm., *sec.* Thoms.

Cadder.

46.[b] N. VIRIDESCENS, *Cam.*

Mugdock.

46.[c] N. SYLVESTRIS, *Cam.*

Cadder.

46.[d] N. CURTISPINA, *Thoms.*

This is a good species.
Cadder, Mugdock.

48.[a] N. MACULIGER, *Cam.*

Cadder.

48.[b] N. ORBITALIS, *Cam.*

Cadder, Ballantrae.

N. SHARPI.

=*N. crassulus*, which again is identical with *N. leucostictus*, Htg.

49.[a] N. TOGATUS, *Zad.*

Arran.

N. VOLLENHOVENI.

This certainly differs from the ordinary Continental form of *N. viminalis*, (=*salicis-cinereae*, Retz.), but it is doubtful if it is really distinct from that species.

N. PEDUNCULI.

Perhaps this is only a form of the above; it is identical with *N. bellus*, Zad.

N. FEMORALIS.

=*ischnocerus*, Thoms. Common at New Galloway.

56.[a] N. NIGROLINEATUS, *Cam.*

Kilpatrick Hills, Milngavie.

57.[a] N. CURTICORNIS, *Cam.*

Rannoch.

CRYPTOCAMPUS.

This name is changed to the earlier one of *Euura*, Newman.

1.[a] E. FLAVIPES, *Cam.*

Rare. Rannoch, Milngavie.

1.[b] E. NIGRITARSIS, *Cam.*

Common in Clydesdale, Cadder, Mugdock. The larvae live in the leaf-buds of willows.

In Cadder Wilderness I have found the leaf-stalks inflated and inhabited by the larvae of an *Euura*. The species is probably *E. venusta*, Zaddach, but I have not yet succeeded in rearing the flies.

HYLOTOMA.

H. USTULATA.

Common at Thornhill.

H. ENODIS.

This is *gracilicornis*, Kl.

4. H. CAERULESCENS, *Retz.*

Near Paisley *(Dunsmore)*.

LOPHYRUS.

L. PALLIDUS.

Houston.

LYDA.

L. ERYTHROCEPHALA.

Pitlochry.

L. SYLVATICA.

Thornhill.

3.[a] L. INANITA, *Devill.*

Thornhill.

5.[a] L. PALLIPES, *Zett.*

=*variegata*, Zad.

Rare. Pitlochry *(A. Beaumont)*.

5.[b] L. CINGULATUS, *Latr.*

=*suffusa*, Htg. = *balteata*, Zad.

Braemar.

5.[c] L. HORTORUM, *Klug.*

=*balteata*, Fall., Thoms.

New Galloway.

XYELA.

P. PUSILLA =JULII.

Pitlochry *(A. Beaumont)*.

COMPARATIVE TABLE SHOWING THE DISTRIBUTION OF THE SCOTCH TENTHREDINIDAE (see also p. 50).

GENERA.	Number of Western Species.	Number of Eastern Species.	Species peculiar to West.	Species peculiar to East.	Number of Clydesdale Species.	Species common to East and West.	Total number of Scotch Species.	Total number of British Species.	Number of English Species.	Species peculiar to Scotland.	Species peculiar to England.	Species common to England and Scotland.
Tenthredo	18	16	4	2	16	14	20	24	21	3	4	17
Tenthredopsis	14	12	5	3	6	9	17	21	15	6	4	11
Synaerema	1	..	1	...	1	...	1	1	1	...	...	1
Macrophya	3	2	2	1	2	1	4	10	10	...	7	3
Pachyprotasis	3	3	...	..	2	3	3	4	4	...	1	3
Allantus	2	1	1	...	2	1	2	10	10	...	8	2
Sciopteryx	1	1	...	...	...	1	1	1	1	...	...	1
Athalia	3	3	1	1	3	2	4	6	6	...	2	4
Dolerus	16	12	5	1	14	11	17	29	24	5	12	12
Strongylogaster	6	3	3	...	5	3	6	7	3	4	1	2
Poecilosoma	5	4	2	1	5	3	6	9	8	1	3	5
Taxonus	3	3	1	1	3	2	4	5	4	1	2	2
Emphytus	8	7	2	1	8	6	9	13	13	...	2	6
Phyllotoma	3	3	...	...	3	3	3	5	5	...	2	3
Fenusa	7	3	4	...	7	3	7	9	8	1	2	6
Fenella	1	...	1	...	1	...	1	2	1	1	1	...
Heptamelus	1	..	1	...	1	.	1	1	1	...	...	1
Selandria	6	5	1	...	5	5	6	8	7	1	2	5
Eriocampa	3	5	...	2	3	3	5	7	6	1	2	4
Blennocampa	12	11	3	2	11	9	14	24	22	2	10	12
Hoplocampa	4	1	3	...	3	1	4	9	7	2	4	3
Dineura	5	4	1	...	5	4	5	7	7	..	2	5
Hemichroa	2	2	...	...	2	2	2	2	2	...	...	2
Camponiscus	1	1	..	..	1	1	1	1	1	...	..	1
Euura	5	4	1	...	4	4	5	5	3	2	...	3
Nematus	64	54	28	18	44	36	82	107	69	38	25	44
Croesus	3	2	1	..	3	2	3	3	3	...	...	3
Cladius	4	5	1	2	4	3	6	7	7	...	1	6
Cimbex	1	2	...	1	1	1	2	3	3	...	1	2
Trichiosoma	3	4	...	1	3	3	4	4	4	.	...	4
Abia	1	1	...	...	1	1	1	1	1	...	.	1
Zaraea	1	..	1	...	1	...	1	2	2	...	1	1
Hylotoma	4	1	3	...	4	1	4	12	12	...	8	4
Cyphona	...	1	..	1	...	...	1	2	2	..	1	1
Lophyrus	2	4	1	3	1	1	5	6	2	4	1	1
Lyda	5	6	3	4	3	2	9	13	10	3	4	6
Xyela	...	1	...	1	...	...	1	1	1	..	...	1
Cephus	1	1	...	...	...	1	1	9	9	...	8	1
	222	188	80	46	178	142	268	390	315	75	126	189

OBS.—The British genera not found in Scotland are *Clavellaria* (one species), *Amasis* (two species), *Harpiphorus* (one species), and *Tarpa* (three species), making 397 British species in all.

Family: SIRICIDAE.

Tribe: XIPHYDRINA.

Genus: XIPHYDRIA, Lin.

1 X. CAMELUS, *Lin.*

"South of Scotland" (Stephens Ill. Brit. Ent., vii.). I have never seen this species myself in Scotland.

Tribe: SIRICINA.

Genus: SIREX, Lin.

Sirex gigas, Lin., and *S. juvencus*, Lin., have both been found in numerous localities in Scotland; but as they are so easily introduced in timber from other countries, I am not in a position to say that they are really native. Certainly, the vast majority of the specimens of *gigas* are importations from Norway and Sweden. I have a specimen of *S. gigas* from Port-Glasgow with the pronotum yellow. American species are occasionally introduced—*e.g.*, *S. albicornis*.

CYNIPIDAE.

In the *Transactions of the Glasgow Society of Field Naturalists*, 1874, p. 44-51, I gave a catalogue of the gall-making *Cynipidae* known to me at that time to inhabit Scotland, enumerating 31 species (or rather species as then regarded). Two years later, in *Lists of the Fauna and Flora of the West of Scotland* (British Association Guide), p. 17, this list was increased to 41 species (so-called), and in addition catalogued 45 inquiline and parasitic species for the West of Scotland. Since that time the observations of Dr. Adler have completely revolutionised our views of the species and genera of the gall-making species,—and in the present catalogue the species are regarded from a totally different standpoint. It is now known beyond dispute that the species of gall-making *Cynipidae* fall under two divisions, —one agamic—the other with an agamic autumnal brood, followed by a spring bi-sexual brood, each differing greatly

in structure, size, and coloration from the other, and inhabiting completely different galls. Both groups had been described under different generic and specific names, which had to be revised, and the limits of the genera created by Hartig and Foerster redefined. This needful task has been admirably performed by Prof. G. L. Mayr in the two publications noted at foot.* Regarding the specific nomenclature, it has been suggested (Magretti, *Sugli Imen. d. Lombardia*, (2) p. 6) that in future a compound name should be adopted for the dimorphic species; *Biorhiza aptera*, for example, to be called *Biorhyzatersa apterminalis*.

Apart from this nomenclature being rather cumbersome, it really is not necessary, since we recognise that the species is actually dimorphic, and that if we call it by one name—*Biorhiza aptera*—we mean by that the species in all its forms and phases. I therefore only adopt one name, that, namely, under which the species was first described, whether in the sexual or agamic stage.†

The genera I adopt as limited by Dr. Mayr, and I have given a synopsis of them as defined by him. I have also given a synoptical table of the galls, which will, I trust, render their identification easy.

The distribution of the gall-making species appears to be co-extensive with the food-plants; locally they are affected by the presence or absence (with the oak species) of the kinds of tree on which they flourish best. I do not, consequently, think it necessary to state, for the common species, their range over Scotland, when I have clear evidence that they are universally distributed. The parasitic species, however, are very little known, and I have given their distribution so far as I know it.

The list of the gall-making species is tolerably complete. With very few exceptions we have all the North-West European species, and all the British except two, these being

* Die Europäischen Arten der Gallenbewohnenden Cynipiden, and Die Genera der Gallenbewohnenden Cynipiden.

† It is, however, often a great convenience to call the galls by the names under which they were first described.

Rhodites rosarum and *Dryophanta agama*, recorded from the South of England. The distribution of the parasitic species is too little known to make any remarks on their distribution of any value.

SYNOPSIS OF THE GENERA AS DEFINED BY Dr. MAYR.

Females.

1 (4) Wingless.

2 (3) Furrows of parapsides complete; antennae 14-jointed; a short, thickish keel between the antennae; head swollen behind the eyes; ventral spine 1-1½ times longer than broad, *Biorhiza*.

3 (2) Furrows of parapsides incomplete; antennae 13-14-jointed; no keel between the antennae; head not swollen behind; ventral spine 2-2½ times longer than broad, - - *Trigonaspis*.

4 (1) Winged.

5 (6) Petiole rugosely longitudinally striated, the second and third abdominal segments without any visible suture; face obliquely striated; frontal keels usually reaching to the ocelli; radial cellule closed; antennae 14-jointed, - - *Synergus*.

6 (5) Petiole smooth, not striated, frontal keels absent.

7 (8) Face with two distinct parallel keels going from the antennae to the base of clypeus; antennae 12-jointed; scutellum with two foveae at the base; third abdominal segment longer than the second, closely united, but still with the suture visible, the third segment covering the greater part of the abdomen; radial cellule closed; claws bifid, - - - *Ceroptres*.

8 (7) Face without keels.

9 (10) Hypopygium ploughshare-shaped, ending in a sharp point, and without a distinct ventral spine; mesopleura with a distinct longitudinal furrow, sometimes punctured; radial cellule completely closed; claws simple, - - - *Rhodites*.

10 (9) Hypopygium not ending in a sharp point, incised beneath, and having a ventral spine.

11 (12) Scutellum not separated from the mesonotum by a suture; no ridge-like border behind the depression at base; furrows of parapsides absent, or, if present, only reaching to the middle; antennae and tibiae not hairy; antennae 13-15-jointed, *Neuroterus*.

12 (11) A suture between the mesonotum and scutellum, a ridge-like border behind the foveae.

13 (14) Abdomen, especially from the third segment to the apex, closely covered with silky hair; antennae, head, and legs pilose; head swollen behind; furrows of parapsides complete; scutellum broader than long, with two foveae at the base. *Cynips.*

14 (13) Abdomen not silky-haired.

15 (16) Cheeks with a sharp furrow; antennae 14-jointed, the flagellum thin, attenuated towards the apex; furrows of parapsides sharp and complete; mesonotum polished; foveae at base of scutellum separated by a sharp keel; metanotum with two curved carinae; second joint of tarsi as long as terminal; claws bifid; abdomen red, - - - - *Trigonaspis.*

16 (15) Cheeks without a furrow; the apex of flagellum not thinner than the middle.

17 (18) Front, vertex, mesonotum, and mesopleura shining, smooth, glabrous; antennae 13-14-jointed; scutellum with two sharply separated foveae at base; pronotum with two small foveae near the middle; metanotum with two parallel carinae; claws simple, - - - - - - - - *Xestophanes.*

18 (17) Head and mesothorax not shining and polished.

19 (20) Second and third abdominal segments without a suture, so that there are only six segments apparent; cheeks without furrows; face laterally striated; head not swollen behind the eyes; metanotum with two parallel keels; pronotum not narrowed in the middle, and with two, not very distinct, keels; mesonotum finely punctured and pilose; antennae 12-jointed, the third joint shorter than the fourth, or equal to it; claws bifid, - - - - - - *Periclistus.*

20 (19) Second and third abdominal segments not united.

21 (24) Cheeks more than half as long as the eyes, without a furrow; last joint of flagellum not thicker than the fifth or sixth, pronotum scarcely narrowed in the middle; furrows of parapsides complete; two sharply separated foveae at base of scutellum; ventral spine at the most scarcely longer than broad; antennae 13-14-jointed; radial cellule short, broad.

22 (23) Claws bifid, mesonotum polished, - - - *Diastrophus.*

23 (22) Claws simple, mesonotum clearly shagreened or punctured, opaque, - - - - - - - - - - - *Aulax.*

24 (21) Cheeks half as long as the eyes; apical joints of flagellum thicker than the fifth or sixth; pronotum small; radial cellule longish, narrow, open.

25 (26) Base of scutellum with two sharply-separated foveae; carinae on metanotum straight and parallel, seldom curved or diverging towards the apex; furrows of parapsides sharp and complete; antennae and tibiae not covered with hairs; the third joint longer than the fourth, - - - *Andricus.*

26 (25) Base of scutellum with a transverse furrow, or with two sharply separated foveae; in the latter case the keels on metanotum curved.

27 (28) Claws single; antennae and tibiae not covered with stiff hairs, base of scutellum with two foveae, mesonotum polished; body yellowish, - - - - - - - - - *Biorhiza.*

28 (27) Claws bifid; antennae and tibiae closely covered with stiff hairs; a transverse furrow at base of scutellum; the agamic form hairy, especially on the legs and antennae; thorax opaque, shagreened; sexual form polished, glabrous, - *Dryophanta.*

MALES.

1 (2) Petiole rugosely longitudinally furrowed, face sharply striated; frontal keels seldom short and indistinct; radial cellule closed; antennae 15-jointed, third joint sometimes enlarged, *Synergus.*

2 (1) Petiole not longitudinally furrowed.

3 (4) Face with two parallel keels between the antennae and clypeus; antennae 15-jointed, the third never enlarged and as long as the fourth; base of scutellum with two foveae; metanotum with two parallel carinae, - - - - - *Ceroptres.*

4 (3) Face without keels.

5 (6) Mesopleurae on lower side with a stout, often punctured or reticulated longitudinal furrow; third antennal joint the longest; radial cellule closed; claws simple, - *Rhodites.*

6 (5) Mesopleurae without a longitudinal furrow.

7 (8) No transverse keel behind the depression at base of scutellum; abdomen petiolated; furrows of parapsides absent or indistinct, - - - - - - . - *Neuroterus.*

8 (7) A transverse keel behind the foveae at base of scutellum.

9 (10) Cheeks with a sharp furrow; antennae longish, thin, 15-jointed, the joints at least three times as long as thick; mesonotum polished, the furrows complete; metanotum with two keels; two foveae at base of scutellum separated by a sharp keel, *Trigonaspis.*

10 (9) Cheeks without a furrow.

11 (12) Second and third abdominal segments amalgamated, with scarcely a trace of suture; abdomen not petiolated; antennae 14-jointed; radial cellule closed; claws bifid; mesonotum finely rugosely punctured, - - - - *Periclistus.*

12 (11) Second and third abdominal segment not closely amalgamated, the suture quite distinct.

13 (14) Vertex, front, mesonotum, mesopleurae polished, glabrous; pronotum with two foveae in front, polished between them; antennae 14-jointed; claws simple; radial cellule open in front, - - - - - - - - - *Xestophanes.*

14 (13) Only the mesonotum polished; pronotum without foveae.

15 (18) Cheeks at least half as long as the eyes; the radial cellule not usually elongated; abdomen not petiolate.

16 (17) Claws bifid; mesonotum shining, impunctate; antennae 14-jointed, - - - - - - - - *Diastrophus.*

17 (16) Claws simple; mesonotum shagreened, opaque; antennae 14-15-jointed, - - - - - - - - - *Aulax.*

18 (15) The cheeks less than one-half as long as the eyes; radial cellule open, longish, narrow.

19 (20) Keels of metanotum straight and parallel, or very short; antennae 14-16-jointed; sutures of mesonotum complete, deep; two distinctly separated foveae at base of scutellum; abdomen scarcely petiolated, - - - - *Andricus.*

20 (19) Keels of metanotum hardly curved; antennae 15-jointed.

21 (22) Reddish-yellow; antennae thick, third joint longer than fourth, strongly emarginated; mesonotum shining; claws simple; abdomen scarcely petiolated, - - - - *Biorhiza.*

22 (21) Mesonotum not reddish-yellow; the antennae thin, the third joint emarginated; abdomen petiolated; claws bifid, *Dryophanta.*

Obs. – *Cynips* has no known male.

SYNOPSIS OF THE SCOTTISH OAK GALLS.

1 (19) Situated on the underside of the leaves.

2 (7) Round, soft and succulent, often with rosy cheeks.

3 (6) Appearing in the spring or early summer; diameter not more than 6 mm.; green.

4 (5) Smooth, glabrous, - - *Neuroterus (Spathogaster) baccarum.*

5 (4) Covered with long white hairs, *Neuroterus (tricolor) fumipennis.*

6 (3) Appearing in the autumn, yellowish-green; diameter 8 to 12 mm., - - - - - - - - *Dryophanta folii.*

7 (8) Oval or ovoid, smooth, glabrous, pallid green or yellow, or brownish yellow, spotted with pink dots; moderately hard, situated between two brownish sheaths, which remain after the gall has fallen; length, 1.5-2.5 mm.; in August and September, - - - - - - - *Andricus ostreus.*

8 (9) Reniform, small, green, succulent, crowded usually together; September and October; length, 1-2 mm., *Trigonaspis (renum) megaptera.*

9 (12) Semi-spherical, depressed at top and bottom, hard and woody; in autumn.

10 (11) Whitish-yellow, sometimes with red bands, or with the sides red; the skin rough, with projecting points; length, 5-7 mm., *Dryophanta longiventris.*

11 (10) Whitish-yellow, often entirely brownish-red, or with reddish cheeks, the skin smooth, bare, shining; length, 4-5 mm., *Dryophanta divisa.*

12 (17) Flat, lenticular, circular, often irregular; length, 1-5 to 5 mm. Appearing in the autumn; gregarious.

13 (14) Almost glabrous, whitish-green to red, a raised knob in the centre, the margin turned up, irregular, *Neuroterus laeviusculus.*

14 (13) Covered with stellate reddish hairs.

15 (16) Underside without hair, flat; pale-yellow, seldom red, sides not distinctly curled up, *Neuroterus (lenticularis) baccarum.*

16 (15) Underside hairy, the sides curled up, red, *Neuroterus fumipennis.*

17 (18) Round, depressed in the centre, covered all over with silky brown depressed hair; occurring in numbers on a leaf in August and September, - - *Neuroterus numismatis.*

18 (17) Flat, round, sunk as it were in the leaf, appearing through both sides, green; July, *Neuroterus (vesicatrix) numismatis.*

19 (26) Situated on the margin of the leaf, without an inner gall.

20 (21) Smooth, ovoid, seed-like, greenish-yellow; length, 1-2 mm.; in June and July, - - *Neuroterus (albipes) laeviusculus.*

21 (22) More or less spindle-shaped, or oblong.

22 (23) Shortly stalked, green, often with red longitudinal lines, the apex ending in a point; length, 6-8 mm.; in October, *Andricus seminationis.*

23 (22) Not stalked.

24 (25) The surface granular, shining, greenish-yellow, often reddish, spotted with small pale spots, brownish when old; length, 4 mm.; in May, - - *Dryophanta (verrucosus) divisa.*

25 (24) The surface glabrous, irregularly ribbed or keeled longitudinally, green; length, 4-5 mm.; in June and July,
Andricus marginalis.

26 (27) An irregular, often globular or oval swelling at the base of the leaf; green, smooth, a large central cavity containing a small brown ovoid seed-like inner gall not attached to the outer shell; May and June, - - *Andricus (curvator) collaris.*

27 (28) A small swelling (2-3 mm. in length) on the midrib, green, projecting through both sides; in August,
Andricus (testaceipes) Sieboldii.

28 (57) In the leaf-buds.

29 (30) Polythalamous, large (often 1 inch and more in diameter), whitish-yellow, soft and spongy, in the terminal buds; May and June, - - - - *Biorhiza (terminalis) aptera.*

30 (29) Monothalamous, not spongy in texture.

31 (35) In twigs on the trunk or near the ground.

32 (33) Roundish, soft, juicy, bare, whitish-yellow, often reddish, usually found near the ground among moss, &c.; in May. Length 5-7 mm., - - - - *Trigonaspis megaptera.*

33 (34) Oblong, shortly pilose—on adventitious buds near the foot of the tree. Violet, sometimes bluish-green, covered with a very short velvety pale pubescence; in June,
Dryophanta (Taschenbergi) folii.

34 (33) Greenish, or greyish-green, covered with longish (comparatively) white hair; in May and June, *Dryophanta (similis) longiventris.*

35 (59) In twigs on the branches.

36 (37) Large, round, marble-like, greenish-yellow; when young with red cheeks, brown when old, not falling down; in August,
Cynips Kollari.

37 (36) Small, dropping off when mature.

38 (39) Covered with a dense covering of brownish-white hair; spindle-shaped; length, 5-8 mm.; July, - - *Andricus solitaria.*

39 (38) Bare, not covered with woolly hair.

40 (43) Spindle-shaped, with a more or less longish peduncle—green, often with red longitudinal lines.

41 (42) The peduncle as long, or nearly as long, as the gall; June, July, and August; 7-12 mm., - - - *Andricus callidoma.*

42 (41) The peduncle very short; October; 6-8 mm., *Andricus Malpighii.*

43 (44) The gall very small (about 1-2 mm.), ovoid, granular, green; June, - - - - - *Andricus (gemmatus) corticis.*

44 (43) Not very small.

45 (46) The gall enveloped in greatly developed leaf-scales, hiding the gall completely, forming a miniature artichoke-like body; length, from 20 mm.; in August, - - *Andricus gemmae.*

46 (45) The leaf-buds not greatly developed and not completely hiding the galls; length not more than 5 mm.

47 (50) Globular, or at least not longer than wide.

48 (49) In April or beginning of May; irregularly pea-shaped; green; surrounded by the bud-scales, - - *Neuroterus aprilinus.*

49 (48) In September and October; the gall with only its apex appearing out of the bud; green and smooth when fresh, when old becoming reticulated, - - - - *Andricus globuli.*

50 (47) Oblong, longer than broad.

51 (52) Green, spotted with white; length, 5-6 mm.; the apex without a sharp point; appearing in May and June, *Andricus albopunctata.*

52 (51) Not spotted with white; appearing in September and October.

53 (54) The surface covered with whitish short hair, finely rugose; often keeled; conical, with a fine point at the apex; brownish-yellow; reddish when young, *Andricus Clementinae.*

54 (53) The surface glabrous, shining, not finely rugose.

55 (57) The apex ending in a distinct nipple-like point of a darker colour than the gall, - - - - *Andricus collaris.*

56 (56) Not ending in a nipple-like point, - *Andricus autumnalis.*

57 (58) The apex of a terminal twig inflated, the inflation longer than broad, the cavity large, and containing the small inner gall; in May, June, and July,
Andricus inflator and *A. curvator.*

58 (59) The twigs or the midribs inhabited by the larvae, which cause irregular swellings; in July, - *Andricus (noduli) radicis.*

59 (62) On the roots.

60 (61) Polythalamous, hard, brown, irregular, from 1 to 3 inches in length, situated close to the ground, - *Andricus radicis.*

61 (60) Monothalamous, situated on the rootlets, often in clusters, irregular in shape, - - - - - *Biorhiza aptera.*

62 (63) In the bark on the thick roots, or on the trunk where there is a wound; the gall sunk in the young wood; cap-shaped—conical at apex; the top falling off when old, *Andricus corticis.*

63 (64) A swelling on the trunk where a wound has been, not differing from the root galls, - - - - - *Andricus radicis.*

64 (65) On young branches, covered with earth or vegetation; conical, hard, woody, deeply furrowed, reddish-brown, reddish and juicy when young, - - - - - *Andricus Sieboldii.*

65 (64) On the catkins.

66 (69) The small galls enveloped in a mass of woolly hair.

67 (68) The mass of hair large, from 20 mm., dense; June,
Andricus ramuli.

68 (67) The mass of hair small, not dense; May and June,
Andricus (cirratus) callidoma.

69 (70) Globular, bare, succulent, green with reddish cheeks,
Neuroterus baccarum.

70 (71) Spindle-shaped, shortly pedunculated, green, tinged with red,
Andricus seminationis.

71 (72) Irregularly oblong or oval, the sides keeled; green; at least 3 mm. in length, - - - - - *Andricus 4-lineatus.*

72 (71) Small (1-2 mm.), oval or oblong, the sides not furrowed.

73 (74) Bare, granular, green, then brownish, *Andricus (nudus) Malpighii.*

74 (73) Covered with longish white hair,
Andricus amenti and *A. (pilosus) gemmae.*

75 (65) In young half-developed acorns which are somewhat distorted,
Andricus?

Obs.—The name under which the alternate generation was described is given in brackets; when only one specific name is given, it is that by which the species in all its stages is to be known.

CYNIPIINA.

Genus: NEUROTERUS.

Neuroterus, Hartig, Germ. Zeit., ii. 135; Mayr, D. Genera d. gall. Cynipiden, 37 (Agamic).
Spathegaster, Hartig, *l. c.* 186 (part) (Bisexual).
Ameristus, Foerster, Verh. z.-b. Ges. Wien 1869, 333.

i.—With Bifid Claws.

1. N. baccarum, *Lin.*

Cynips quercus-baccarum, Lin., Syst. Nat., ii. 917.
Cynips lenticularis, Oliv., Enc. Méth., vi. 281.
Neuroterus Malpighii, Hartig, Germ. Zeit., ii. 192.
Neuroterus lenticularis, Adler, Zeit. f. wiss. Zool. 1880, 156, pl. x. f. 1; Mayr, Europ. Cyn., 39; Eichen-Gallen, 45, pl. vi. f. 63.
Spathegaster interruptor, Htg., *l. c.*, iii., 341.
Do. baccarum, Htg., *l. c.*; Adler, Zeit. f. wiss. Zool. 1880, 160, pl. x. f. 1ª; Mayr, Europ. Cyn., 38; Eichen-Gallen, 49, pl. vi. f. 70.
Abundant everywhere—especially in Cadder Wilderness and Mugdock Wood.

2. N. fumipennis, *Htg.*

Neuroterus fumipennis, Htg., Germ. Zeits., iii. 339; Mayr, Europ. Cyn., 38; Eichen-Gallen, 45, pl. vi. f. 64; Adler, Zeit. f. wiss. Zool. 1880, 164 pl. x. f. 4.
Spathegaster tricolor, Htg., *l. c.* 341; Mayr, Eichen-Gallen, 49, pl. vi. f. 71; Europ. Cyn. 38; Adler, *l. c.* 165, pl. x. f. 4ª.
Spathegaster varius, Schenck, Nauss. Cynip., 87.
Widely distributed, but local—Mugdock, Cadzow.

3. N. NUMISMATIS, *Oliv.*

Cynips numismatis, Oliv., Enc., Méth., v. 787.
Neuroterus Reaumuri, Htg., Germ. Zeit., ii. 192.
Do. numismatis, Mayr, Eichen-Gallen, 44, pl. vi. f. 62; Europ. Cyn., 39; Adler, Z. wiss. Zool. 1880, 163, pl. x. f. 3.
Spathegaster vesicatrix, Schlechtendtal, J.B. ver. Zwickau, 1871, 33; Mayr, Eichen-Gallen, 51, pl. vi. f. 74; Eur. Cyn., 39; Adler, *l. c.* 163, pl., x. f. 3.
Abundant—Cadder, Kenmuir, Milngavie, &c.

4. N. LAEVIUSCULUS, *Schenck.*

Neuroterus laeviusculus, Schenck, Nauss. Cyn., 70; Mayr, Eichen-Gallen, 46, pl. vi. f. 65; Europ. Cyn., 38; Adler, Z. wiss. Zool. 1880, 161, pl. x. f. 2.
Neuroterus pezizaeformis, Schlecht., Stet. Ent. Zeit. 1870, 384.
Spathegaster albipes, Schenck, Nauss. Cyn., 84; Mayr, Eichen-Gallen, 50, pl. vi. f. 72; Europ. Cyn., 39; Adler, *l. c.* 162, pl. x. f. 2ª.
Common—Cadder, Mugdock.

ii.—Claws Simple.

5. N. APRILINUS, *Gir.*

Spathegaster aprilinus, Giraud, Verh. z.-b. Ges. Wien, 1859, 363; Mayr, Eichen-Gallen, 32, pl. iv. f. 42; Adler, Zeit. f. wiss. Zool., 201, pl. x. f. 19ª.
Neuroterus aprilinus, Mayr, Europ. Cyn., 37.
Rare. Early in May. Cadder. See *Andricus ostreus*, *infra* p. 80.

GENUS: DRYOPHANTA.

Dryophanta, Foerster, Verh. z.-b. Ges. Wien, 1869, 335 (Agamic).
Spathegaster, Giraud, Schlecht. Adler (in part) (Bisexual).

1. D. FOLII, *Lin.*

Cynips quercus folii, Lin., Syst. Nat., ii. 918.
Diplolepis scutellaris, Oliv., Enc. Méth., v. 282.
Cynips folii, Htg., Germ. Zeit., ii. 187.
Dryophanta scutellaris, Adler, Z. wiss. Zool. 1880, 186, pl. xi. f. 14.
Dryophanta folii, Mayr, Europ. Cyn., 36.
Do Taschenbergi, Mayr, *l. c.* 35.
Spathegaster Taschenbergi, Schlecht., Stet. Ent., Zeit. 1870, 391; Adler, *l. c.* 188, pl. xi. f. 14ª.
Local—Cadzow Forest, Tarbet, Loch Lomond, Lochgoilhead, Garelochhead.

2. D. DIVISA, *Htg.*

Cynips divisa, Htg., Germ. Zeit., ii. 188.

Dryophanta divisa, Adler, Z. wiss. Zool. 1880, 190, pl. vi. f. 16; Mayr, Eur. Cyn., 37.

Spathegaster verrucosus, Schlecht., Stet. Ent. Zeit. 1870, 389; Adler, *l. c.* 191, pl. 11, f. 16ª; Mayr, Europ. Cyn., 35.

Common—Cadder, Kenmuir, Mugdock.

3. D. LONGIVENTRIS, *Htg.*

Cynips longiventris, Htg., Germ. Zeit., ii. 188.

Dryophanta longiventris, Adler, Zeit. wiss. Zool. 1880, 189, pl. xi. f. 15; Mayr, Europ. Cyn., 36.

Spathegaster similis, Adler, *l. c.* 190, pl. xi. f. 15ª; Mayr, Europ. Cyn., 35.

Common, but somewhat local—Milngavie, Mugdock, Cadder.

The galls I have found in Scotland are either pale yellow, or pale yellow with reddish cheeks. I have never found them with the red rings as figured and described by Continental authors.

GENUS: BIORHIZA.

Biorhiza, Westwood, Int., ii. Synop. 56; Mayr, Genera, 31 (Agamic).
Apophyllus, Htg., Germ. Zeit., ii. 185.
Teras, Htg., *l. c.* 185 (Bisexual).
Dryoteras, Foerster, Verh. z.-b. Ges. Wien, 1869, 331.

1. B. APTERA, *Fab.*

Cynips aptera, Fab., Ent. Syst. ii. 104.
Cynips quercus terminalis, Fab., Ent. Syst. Supp., 213.
Teras terminalis, Adler, Zeit. wiss. Zool. 1880, 194, pl. xi. f. 17ª.
Biorhiza terminalis, Mayr, Europ. Cyn., 32.
Do. aptera, Adler, *l. c.* 192, pl. xi. f. 17; Mayr, Eur. Cyn., 32.
Common, but local—Kenmuir, Cadder, Mugdock.

GENUS: TRIGONASPIS.

Trigonaspis, Htg., Germ. Zeit., ii. 186; Mayr, Genera, 30, 21.
Biorhiza, West. Int. ii., Synop. 56 (in part).

1. T. MEGAPTERA, *Pz.*

Cynips megaptera, Pz., Fauna Germ., 79, 7.
Trigonaspis crustalis, Htg., Germ. Zeit., ii. 195; Adler, Zeit. wiss. Zool. 1880, 198, pl. xi. f. 18ª.
Trigonaspis megaptera, Mayr, Europ. Cyn., 31.
Trigonaspis renum, Mayr, *l. c.* 31.

Biorhiza renum, Giraud, Verh. z.-b. Ges. Wien, 1859, 362; Adler, *l. c.* 197, pl. xi. f. 18.

Common—Kenmuir, Cadder, Mugdock.

Genus: ANDRICUS.

Andricus, Htg., Germ. Zeit., ii. 185; Mayr, Genera, 27.
Callirhytis, Foer., Verh. z.-b. Ges. Wien. 1869, 335 (Sexual).
Aphilothrix, Foer., *l. c.* 336 (Agamic).

1. A. gemmae, *Lin.*

Cynips quercus gemmae, Lin., Syst. Nat., 1525.
Cynips fecundatrix, Htg., Germ. Zeit., iii. 335.
Aphilothrix fecundatrix, Adler, Zeit. wiss. Zool. 1880, pl. x. f. 10.
Do. gemmae, Mayr, Eichen-Gallen, 23, pl. iii. f. 28.
Andricus pilosus, Adler, *l. c.* 180, pl. x. f. 10ª; Mayr, Eur. Cyn., 19.
Andricus fecundatrix, Mayr, Eur. Cyn., 23.

The well-known artichoke gall of the oak. Common—Cadder, Mugdock, Kenmuir.

2. A. inflator, *Htg.*

Andricus inflator, Htg., Germ. Zeit., ii. 191; Mayr, Eichen-Gallen, 29, pl. iv. f. 38 and 38ª; Europ. Cyn., 20; Adler, Zeit. wiss. Zool. 1880, 176, pl. x. f. 8ª.
Cynips globuli, Htg., *l. c.* iii., 336.
Andricus globuli, Mayr, Eur. Cyn., 23; Adler, *l. c.* 174, pl. x. f. 8.

Widely distributed, but very local—Cadzow.

3. A. radicis, *Fab.*

Cynips radicis, Fab., Syst. Ent. Supp., 213.
Aphilothrix radicis, Adler, Zeit. wiss. Zool. 1830, 167, pl. x. f. 5.
Andricus trilineatus, Htg., Germ. Zeit., ii. 191.
Do. noduli, Htg., *l. c.* ii. 191; Adler, *l. c.* 169, pl. x. f. 5ª.
Do. radicis, Mayr, Eur. Cyn., 26.

Common—Kenmuir, Cadder, Mugdock.

The galls of the agamic form *(radicis)* are found on the trunks of the trees as well as on the roots.

4. A. testaceipes, *Htg.*

Andricus testaceipes, Htg., Germ. Zeit., ii. 191; Adler, Zeit. wiss. Zool. 172, pl. x. f. 6ª; Mayr, Eur. Cyn., 18 and 28.
Cynips Sieboldii, Htg., *l. c.* iv. 406.
Do. corticalis, Schenck, Nass. Cynip., 63.
Aphilothrix Sieboldii, Adler, *l. c.* 171, pl. x. f. 6.
Andricus Sieboldii, Mayr, Eur. Cyn. 25.

Not uncommon, local—Cadder, Mugdock, Kenmuir.

5. A. CORTICIS, *Htg.*

Cynips corticis, Htg., Germ. Zeit., ii. 190.
Aphilothrix corticis, Adler, Zeit. wiss. Zool. 1880, 173, pl. x. f. 7.
Andricus corticis, Mayr, Eur. Cyn., 25.
Do gemmatus, Adler, *l. c.* 174, pl. x. f. 7ª; Mayr, Eur. Cyn., 19.
Local, but of wide distribution—Kenmuir, Cadder, Mugdock.

6. A. COLLARIS, *Htg.*

Cynips collaris, Htg., Germ. Zeit., ii. 190.
Aphilothrix collaris, Adler, Zeit. wiss. Zool. 1880, 177, pl. x. f. 9.
Andricus collaris, Mayr, Eur. Cyn., 22.
Do. curvator, Htg., *l. c.* ii. 191; Adler, *l. c.* 178, pl. x. f. 9ª; Mayr, *l. c.* 20.
Abundant, and destructive to young trees by the twigs being distorted. On some trees I have counted between 200 and 300 galls (of the *curvator* form).

7. A. RAMULI, *Lin.*

Cynips quercus ramuli, Lin., Syst. Nat., ii. 918.
Teras amentorum, Htg., Germ. Zeit., iv. 408.
Andricus ramuli, Adler, Zeit. weiss. Zool. 1880, 186, pl. x. f. 13ª; Mayr, Eur. Cyn., 15.
Cynips autumnalis, Htg., *l. c.* iii. 336.
Aphilothrix autumnalis, Adler, *l. c.* 185, pl. x. f. 13.
Andricus autumnalis, Mayr, *l. c.* 22.
Apparently very local all over Scotland—Cadzow.

8. A. CIRRATUS, *Adler.*

Aphilothrix callidoma, Adler, Zeit. wiss. Zool. 1880, 182, pl. x. f. 11 (*non* Giraud).
Andricus cirratus, Adler, *l. c.* 182, pl. x. f. 11ª; Mayr, Eur. Cyn., 49 and 28.
Do. callidoma, Mayr, 19, 21, and 28.
Apparently rare—Mugdock, Claddich, Loch Awe.

9. A. MALPIGHII, *Adler.*

Aphilothrix Malpighii, Adler, Zeit. wiss. Zool. 1880, 183, pl. xi. f. 12.
Andricus nudus, Adler, *l. c.* 184, pl. xi. f. 12ª.
Do. Malpighii, Mayr, Eur. Cyn., 21.
Rare—Mugdock, Claddich, Loch Awe.

10. A. AMENTI, *Gir.*

Andricus amenti, Giraud, Verh. z.-b. Ges. Wien, 1859, 360; Mayr, Eichen-Gallen, 57, pl. vii. f. 82, Eur. Cyn., 14.

Rare—Ballater (Trail, Ent. Mon. Mag. x. 85). The galls I recorded from Rannoch (Trans. Glas. Soc. Field Nat. p. 49) may have been the spring galls of *A. gemmae*; but Professor Trail appears to have had the true *amenti*. The agamic form is still unknown.

Agamic Species.

11. A. OSTREUS, *Gir.*

Neuroterus ostreus, Giraud, Verh. z.-b. Ges. Wien, 1859, 350; Adler, Zeit. wiss. Zool. 1880, 199, pl. x. f. 19.

Andricus ostreus, Mayr, Eur. Cyn., 14.

Common—Cadder, Mugdock.

Only the agamic form of this species is known; but Dr. Adler suspects that the sexual form is *Neuroterus aprilinus*. From the fact that Adler observed *ostreus* to lay its eggs in buds in October, it certainly would appear that it should have a spring alternate form. It is found in the same localities as *aprilinus*.

12. A. SEMINATIONIS, *Adler.*

Aphilothrix seminationis, Adler, Z. wiss. Zool. 1880, 202, pl. xi. f. 20.

Cynips inflorescentiae, Schlecht., Stet. Ent. Zeit. 1870, 396 (gall only).

Rare—Cadder.

13. A. ALBOPUNCTATA, *Schl.*

Cynips majalis, Giraud, Bull. Ent. Soc. Fr. 1868, liii. (gall).

Cynips albopunctata, Schlechtendal, Stet. Ent., 1870, 376.

Aphilothrix albopunctata, Adler, Z. wiss. Zool. 1880, 205, pl. xi. f. 23.

Andricus albopunctata, Mayr, Eur. Cyn., 21.

Common—Cadder, Mugdock.

14. A. SOLITARIA, *Fonsc.*

Diplolepis solitarius, Fonscolomb, Ann. Sc. Nat., 1832, T. 26, p. 184.

Cynips ferruginea, Htg., Germ. Zeit. ii. 189.

Aphilothrix solitaria, Mayr, Eichen-Gallen, 23, pl. iii. f. 29.

Andricus solitaria, Mayr, Eur. Cyn., 25.

Rare—Kenmuir, Cadder, Mugdock.

15. A. MARGINALIS, *Adler.*

Aphilothrix marginalis, Adler, Z. wiss. Zool. 1880, 208, pl. xi. f. 21.

Andricus marginalis, Mayr, Eur. Cyn., 21.

Common—Cadder, Mugdock.

16. A. QUADRILINEATUS, *Htg.*

Andricus quadrilineatus, Htg., Germ. Zeit. ii. 190; Mayr, Eur. Cyn., 21.

Do. flavicornis, Schenck, Nauss. Cyn., 75 and 80.

Andricus pedunculi, Schenck, *l. c.* 74, 77, and 111.
Do. *ambiguus*, Schenck, *l. c.* 111.
Do. *verrucosus*, Schenck, *l. c.* 112.
Do. *glabriusculus*, Schenck, *l. c.* 112.
Aphilothrix quadrilineatus, Adler, Zeit. wiss. Zool. 1880, 204, pl. xi f. 22.
Common—Mugdock, Cadder, Bishopton.

Genus : DIASTROPHUS.

Diastrophus, Htg., Germ. Zeit. ii. 186 ; Mayr, Genera, 25.

1. D. rubi, *Htg.*

Diastrophus rubi, Htg., Germ. Zeit. ii. 194.
Cadder, Kenmuir, Cadzow.

Genus : SYNERGUS.

Synergus, Htg., Germ. Zeit. ii. 186.
This is an inquiline genus, the flies depositing their eggs in the galls of other insects, in which they live—cuckoo fashion. The species are very difficult to separate owing to their great variability. The nomenclature is after Mayr's monograph (Verh. z.-b. Ges. Wien xxii.). I am only acquainted with the distribution of the species in Clydesdale, except with a few of the species found in the summer galls.

1. S. thaumacera, *Dal.*

Cynips thaumacera, Dalman, Anal. Ent. p. 96.
Synergus Klugii, Htg., Germ. Zeit. ii. 199.
Do. *luteus*, Htg., *l. c.*
Do. *carinatus*, *l. c.* iii. 348 ?
Do. *thaumacera*, Mayr, Verh. z.-b. Ges. Wien, 719.
Common in galls of *Biorhiza megaptera*.

2. S. Reinhardi, *Mayr.*

Synergus Reinhardi, Mayr, *l. c.* 698.
Not common ; in galls of *Cynips Kollari*—Cadder.

3. S. apicalis, *Htg.*

Synergus apicalis, Htg., Germ. Zeit. iii. 349 ; Mayr, *l. c.* 705.
Synergus immarginatus, Htg., *l. c.* 348.
Do. *erythrostomus*, Htg., *l. c.* 348.
In galls of *Andricus radicis (noduli)* Kenmuir, and in *Neuroterus lenticularis* (agamic) Mugdock.

4. S. INCRASSATUS, *Htg.*

Synergus incrassatus, Htg., Germ. Zeit. ii. 199; Mayr, *l. c.* 707.
In galls of *Cynips Kollari*, Cadder.

5. S. TSCHEKI, *Mayr.*

Synergus Tscheki, Mayr, *l. c.* 708
Common—in galls of *Andricus divisa*, *A. ostreus*, *Neuroterus numismatis*, and *N. lenticularis*.

6. S. PALLICORNIS, *Htg.*

Synergus pallicornis, Htg., Germ. Zeit. iii. 348; Mayr, *l. c.* 709.
Synergus australis, Htg., *l. c.* iv. 414.
Do. *flavicornis*, Htg., *l. c.* ii. 198?
Do. *nigripes*, Htg., *l. c.* ii. 198?
In galls of *Andricus divisa*.

7. S. ALBIPES, *Htg.*

Synergus albipes, Htg., Germ. Zeit. iii. 349; Mayr, *l. c.* 712.
Synergus erythrostomus, Htg., *l. c.* 349.
Common—In galls of *Neuroterus baccarum*, *And. curvator*, and *A. divisa*.

8. S. NERVOSUS, *Htg.*

Synergus nervosus, Htg., Germ. Zeit. ii. 197; Mayr, *l. c.* 713.
Do. *tibialis*, Htg., *l. c.* ii. 197.
Do. *nigricornis*, Htg., *l. c.* iii. 347?
In galls of *And. noduli*, *And. callidoma*, *And. collaris*, and in acorns (see p. 84).

9. S. VULGARIS, *Htg.*

Synergus vulgaris, Htg., Germ. Zeit. ii. 198; Mayr, *l. c.* 715.
In galls of *And. solitaria*, *And. callidoma*, and *Dryophanta Taschenbergi*.

10. S. FACIALIS, *Htg.*

Synergus facialis, Htg., Germ. Zeit. ii. 199; Mayr, *l. c.* 717.
Do. *bispinus*, Htg., *l. c.* iii. 349.
Diplolepis gallaepomiformis, Fourc., Ann. Sc. Nat., xxvi. 195 *(partim)*.
In galls of *And. albopunctata*, *A. solitaria*, *A. curvator*, *A. ramuli*, *Neuroterus baccarum*, *N. tricolor*, and *Biorhiza (terminalis) aptera*.

11. S. RADIATUS, *Mayr.*

Synergus radiatus, Mayr, *l. c.* 718.
In galls of *Andricus albopunctata*, *A. callidoma*, *A. curvator*, and *Neuroterus baccarum*.

GENUS: CEROPTRES.

Ceroptres, Htg., Germ. Zeit. ii. 186.

1. C. ARATOR, *Htg.*

Ceroptres arator, Htg., *l.c.* iii. 343; Mayr, Verh. z.-b. Ges. Wien, xxii. 721.

Rare—in galls of *Andricus (noduli) radicis*—Kenmuir.

GENUS: PERICLISTUS.

Periclistus, Foerster, Verh. z.-b. Ges. Wien, 1869, 337.

The species of *Periclistus* are inquilines in the rose galls of *Rhodites*.

1. P. BRANDTII, *Ratz.*

Cynips Brandtii, Ratzburg, Berl. Jahrb. d. Pharm., 183, 2; Medic. Zool. ii. 151.

Aulax Brandtii, Htg., Germ. Zeit. ii. 196.

Periclistus Brandtii, Mayr, Eur. Cyn., ii.

Rare—in galls of *Rhodites rosae*.

2. P. CANINAE, *Htg.*

Aylax caninae, Htg., *l.c.* ii. 196.

Periclistus caninae, Mayr, Eur. Cyn., ii. 11.

Common in galls of *Rhodites eglanteriae*.

GENUS: XESTOPHANES.

Xestophanes, Foerster, Verh. z.-b. Ges. Wien, 1869; Mayr, Genera, 21.

1. X. POTENTILLAE, *De Vill.*

Cynips potentillae, De Villaret, Lin. Ent. iii. 77.

Aylax splendens, Htg., Germ. Zeit. ii. 196.

Xestophanes potentillae, Mayr, Eur. Cyn., 10.

Forms irregular galls on stems of *Potentilla Tormentilla*.

Common near Milngavie and in Mugdock; Dumfries.

GENUS: AULAX.

Aylax, Htg., Germ. Zeit. ii., 186.

Iscolus, Foerster, Verh. z.-b. Ges. Wien, 1869, 330.

Euborthrus, Foerster, *l. c.* 331.

Liposthenus, Foerster, *l. c.*

The species of this genus raise galls on various plants (not trees). None of them are dimorphic.

1. A. HIERACII, *Bé.*

Cynips hieracii, Bouché, Naturg. d. Ins. 164.

Aylax sabaudi, Htg., Germ. Zeit. ii. 195.

Aulax hieracii, Mayr, Eur. Cyn., 8.

Common, making polythalamous galls on different parts of various species of *Hieracium*, chiefly on the stems and roots.

Possil, Carmyle, Milngavie.

2. A. GRAMINIS, *Cam.*

Aulax graminis, Cameron, Proc. Nat. Hist. Soc. Glas., 1873, 322; Mayr, Eur. Cyn., 8.

Rare—In galls on roots of *Triticum repens* (or perhaps *Arrhenatherum avenaceum*).

Near Partick.

3. A. PAPAVERIS, *Per.*

Diplolepis papaveris, Perris, Ann. Soc. Ent. Fr. 1839, 98.
Aulax rhoeadis, Htg., Germ. Zeit. ii. 195; Mayr, Eur. Cyn., 7.
Berwickshire (Hardy, Trans. Berw. Nat. Club, 1871, 263).

5. A. GLECHOMAE, *Htg.*

Aylax glechomae, Htg., Germ. Zeit. iii. 342.
Liposthenes glechomae, Foer., Verh. z.-b. Ges. Wien, 1869, 336.
Not common, forming galls on stem of *Nepeta glechoma*.
Perthshire (Trail, Scot. Nat. ii., 253).
Ballantrae.

GENUS: RHODITES.

Rhodites, Htg., Germ. Zeit. iv. 186.
Hololexis, Foerster, Verh. z.-b. Ges. Wien, 1869, 330.
The species of this genus are confined to the rose.

1. R. ROSAE, *Lin.*

Cynips rosae, Lin., Syst. Nat. ii. 917.
Rhodites bedeguaris, Htg., Germ. Zeit. ii., 194.
The maker of the well-known "bedeguar" of the rose.

2. R. SPINOSISSIMAE, *Gir.*

Rhodites spinosissimae, Giraud, Verh. z.-b. Ges. Wien, 1859, 367.
Forms irregular galls on the leaves and twigs of *Rosa spinosissima*.
Common all round the coast and in the Hebrides.

3. R. EGLANTERIAE, *Htg.*

Rhodites eglanteriae, Htg., Germ. Zeit. ii. 194.
Hololexis eglanteriae, Foer., Verh. z.-b. Ges. Wien, 1869, 333.

In pea-shaped galls on the leaves of the common rose. The large, irregular polythalamous galls are the ordinary monothalamous galls of *R. eglanteriae*, distorted by *Periclistus caninae*.

Obs.—I have caught several species of *Andricus* and *Synergus*, which I am unable to identify, and their determination must remain undecided at present. Also, I have found the acorns distorted in several localities by *Synergi*, indicating either the presence of some unknown gall-making species, or that the *Synergi* oviposit in the acorns without the way having been prepared for them by some gall-raiser.

Sub-Family: ALLOTRIINA.

Genus: ALLOTRIA, *West.*

Allotria, Westwood, Mag. Nat. Hist. vi. 494.
Xystus, Hartig, Germ. Zeit. ii. 199.

I. *Radial cellule closed.*

1. A. victrix, *West.*

Allotria victrix, Westwood, Mag. Nat. Hist. vi. 494.
Cadder, Dumfries, Claddich, Loch Awe.
Carruber Glen.
Common. In the rose aphis.

2. A. Tscheki, *Gir.*

Allotria Tscheki, Giraud, Verh. z.-b. Ges. Wien, ix. 128.
Mugdock, Cadder, New Galloway, Thornhill.

3. A. ruficeps, *Cam.*

Allotria ruficeps, Cameron, Trans. Ent. Soc., 1883, 365.
Rare—New Galloway.

4. A. ruficollis, *Cam.*

Allotria ruficollis, Cameron, Trans. Ent. Soc., 1883, 365.
Rare—Mull.

5. A. pleuralis, *Cam.*

Allotria pleuralis, Cameron, Trans. Ent. Soc., 1879, 114.
Near Newton, Possil Marsh.

6. A. flavicornis, *Htg.*

Xystus flavicornis, Hartig, Germ. Zeit. iii. 352.
Cadder.

7. A. curvicornis, *Cam.*

Allotria curvicornis, Cameron, Trans. Ent. Soc., 1883, 366.
Glen-Lyon, near Inverwick.

8. A. ancylocera, *sp. nov.*

Black; the head below the eyes piceous-red; the antennae fuscous; joints 2-4 pallid testaceous; legs fuscous-testaceous; the coxae and femora much darker; the four anterior femora lighter-coloured than the posterior at the side, but lined with black above and beneath; wings hyaline; nervures testaceous. Antennae longer than the body; the third joint a little shorter than fourth, slightly curved; the fourth and fifth deeply curved; the apical joint shorter a little than

the penultimate. Radial cellule of moderate length; the curved apical branch of the nervure scarcely double the length of the oblique basal part, the cubital branch extending a little beyond the middle of the wing. Male.

Length scarcely 1·5 mm.

Agrees in general form and coloration with *A. longicornis*, but is smaller; the antennae are scarcely so long, and with the joints 3-5 thicker and distinctly curved; the radial cellule shorter, but with the curved apical branch of the nervure longer in proportion to the basal part. *A. curvicornis* may be known from it by the antennae issuing from distinct tubercles, and distinctly longer, the fourth and fifth joints more twisted, the radial nervure shorter and wider, the cubitus shorter.

Carruber Glen, August 14th.

9. A. LONGICORNIS, *Htg.*

Xystus longicornis, Htg., Germ. Zeit. ii. 199.
Cadder, Mugdock, Dumfries, New Galloway.
Carruber Glen.

10. A. CIRCUMSCRIPTA, *Htg.*

Xystus circumscriptus, Htg., Germ. Zeit. iii. 351.
Cadder, Dumfries.

11. A. MINUTA, *Htg.*

Xystus minutus, Htg., Germ. Zeit. ii. 200.
Clyde above Cambuslang, Cadder, Mugdock, Kilsyth, Dumfries, New Galloway.
Kingussie.

12. A. BREVIS, *Thoms.*

Allotria brevis, Thomson, Oef. xviii. 408, 9.
Mugdock, Dumfries.

13. A. MULLENSIS, *Cam.*

Allotria mullensis, Cameron, Trans. Ent. Soc., 1883, 366.
Mull; rare.

14. A. MELANOGASTER, *Htg.*

Xystus melanogaster, Htg., Germ. Zeit. ii. 200.
Cadder.

II. *Radial cellule open* = *Alloxysta*, Foerster.

15. A. MACROPHADNA, *Htg.*

Xystus macrophadnus, Htg., Germ. Zeit. iii. 352.
Possil Marsh, Mugdock, Bishopton, Lochlibo, New Galloway.
Manuel.

16. A. MACULICOLLIS, *sp. nov.*

Black; head red; antennae and legs yellow, the apex of antennae inclining to fuscous; a large obscure red mark on the sides of prothorax; wings hyaline; nervures fuscous; metathorax, scutellum, and base of abdomen densely covered with longish white hair. Antennae longer by about one-fourth than the body, attenuate, the last joint compressed, longer than the penultimate; fourth joint longer than either the third or fifth. Radial cellule broad, short; the apical branch of the nervure curved, scarcely double the length of the oblique basal portion, which is scarcely one-fourth longer than the cubital branch, cubitus scarcely reaching to the middle. Besides the reddish mark in the centre, the prothorax is reddish-piceous along the edges, especially at the pronotum. Male.

Length somewhat more than 1·5 mm.

Nearly related to *A. macrophadna*, but easily known from it by the much shorter radial cellule, by the reddish prothorax, and by the entirely yellow antennae.

New Galloway.

17. A. DEFECTUS, *Htg.*

Xystus defectus, Htg., Germ. Zeit. iii. 352.

Mugdock, Claddich, Loch Awe, Moffat, Dumfries.

18. A. BASIMACULA, *sp. nov.*

Black; the head (the vertex obscured with black) and base of abdomen red; the five basal joints of antennae and legs yellow; wings hyaline, the nervures testaceous; metathorax and base of abdomen densely covered with long white hair. Antennae a little longer than the body, stout; the fourth joint longer than either the third or fifth; the last joint about one-fourth longer than the preceding. Areolet elongated, of moderate length; the basal branch of nervure scarcely double the length of apical, and not much curved; cubitus not traced. Female.

The male has the antennae longer, with the third joint slightly curved; the femora are darker, the yellow being suffused with fuscous.

Length scarcely 1 mm.

The pleurae and mesonotum incline to piceous. Readily known from the preceding by only the five basal joints of the antennae being yellow, and by only the third joint being curved in the male.

Milngavie, Mugdock.

19. A. CITRIPES, *Thoms.*

Allotria citripes, Thomson, Oef. xviii. 410.

Kenmuir, Claddich, Loch Awe, Mull, Dumfries.

20. A. APERTA, *Htg.*

Xystus apertus, Htg., Germ. Zeit. iii. 353.
Mugdock, Cambuslang.
Bonar Bridge.

21. A. OBSCURATA, *Htg.*

Xystus obscuratus, Htg., Germ. Zeit. ii. 200.
Cambuslang, Cadder, Dumfries, New Galloway.
Kingussie.

22. A. FUSCIPES, *Thoms.*

Allotria fuscipes, Thomson, Oef. xvlii. 410, 18.
Clyde near Newton, Dumfries, New Galloway.
Bonar Bridge.

23. A. PICEOMACULATA, *Cam.*

Allotria piceomaculata, Cameron, Trans. Ent. Soc., 1883, 367.
Dumfries.

24. A. CALEDONICA, *sp. nov.*

Castaneous; the apex of the abdomen black; legs obscure pallid testaceous; the femora darker coloured; antennae infuscated towards the apical half; wings hyaline, nervures testaceous. Antennae as long as the body, stout, not attenuated towards the apex; the third joint a little longer than fourth; the last longer than penultimate, and slightly thinner than it. Radial cellule short, broad; about one-half longer than broad.

Length nearly 1 mm.
Mugdock, 27th July.

III. *Semi-apterous, the wings not reaching beyond the apex of thorax* = *Pezophycta*, Foerster.

25. A. HALTERATA, *Thoms.*

Allotria halterata, Thomson, Oef. xviii. 410.
Kelvinside, Kenmuir.

26. A. BRACHYPTERA, *Htg.*

Xystus brachyptera, Htg., Germ. Zeit. ii. 200.
Mugdock, Dalry, New Galloway.
Bonar Bridge.

27. A. PEDESTRIS, *Curtis.*

Cynips pedestris, Curtis, Brit. Ent. 320, No. 32.
Xystus cursor, Htg., Germ. Zeit. ii. 200.
Possil, New Galloway, Mull.

GENUS: HEMICRISIS.

Hemicrisis, Foerster, Verh. z.-b. Ges. Wien, xix. 339.

1. H. SALICIS, *Cam.*

Hemicrisis salicis, Cam., Trans. Ent. Soc. 1883, 367.
Kilpatrick Hills in a black aphis on *Salix pentandra*.

Sub-Family: FIGITINA.

Tribe: EUCOILIDES.

GENUS: EUCOILA.

Eucoila, Westwood, Mag. Nat. Hist. viii. 174.
Cothonaspis, Htg., Germ. Zeit. ii. 200.

1. E. MANDIBULARIS, *Zett.*

Figites mandibularis, Zett., Ins. Lapp. 410.
Clyde near Newton.

2. E. ERYTHROCERA, *Thoms.*

Eucoila erythrocera, Thomson, Opus. Ent. 820.
Clober, Clyde near Cambuslang.

3. E. CILIARIS, *Dbm.*

Eucoila ciliaris, Dbm., Sk. Hymen. Fn. 31, 11.
Possil Marsh, Dalry.

4. E. CUBITALIS, *Htg.*

Cothonaspis cubitalis, Htg., Germ. Zeit. iii. 356.
Mugdock; Clyde opposite Kenmuir.

GENUS: PSICHARCA.

Psicharca, Foerster, Verh. z.-b. Ges. Wien, xix. 356.

1. P. SIMILIS, *Cam.*

Psicharca similis, Cameron, Trans. Ent. Soc. 1883, 368.
Kelvinside, Cambuslang.

2. P. GLOTTIANA, *Cam.*

Psicharca glottiana, Cameron, Trans. Ent. Soc. 1883, 368.
Dalry, Cambuslang.

GENUS: PSILODORA.

Psilodora, Foerster, Verh. z.-b. Ges. Wien, xix. 354.

1. P. Boienii, *Htg.*

Cothonaspis Boienii, Htg., Germ. Zeit. ii. 200.
Bishopton, on dung.

2. P. maculatus, *Htg.*

Figites syrphi, Newman, Ent. Mag. ii. 515?
Cothonaspis maculatus, Htg., *l. c.* ii. 201.
Cadder.
Manuel.

Genus : RHOPTROMERIS.

Rhoptromeris, Foerster, Verh. z.-b. Ges. Wien, xix. 356.

1. R. eucerus, *Htg.*

Cothonaspis eucerus, Htg., Germ. Zeit. iii. 357.
Dalry.
Rannoch, 3000 feet.

Genus : TRYBLIOGRAPHA.

Trybliographa, Foerster, Verh. z.-b. Ges. Wien, xix. 359.

1. T. scutellaris, *Htg.*

Cothonaspis scutellaris, Htg., Germ. Zeit. ii. 200.
Cambuslang.

2. T. nigricornis, *Cam.*

Trybliographa nigricornis, Cam., Trans. Ent. Soc. 1883, 369.
Cadder, Clober, Dumfries.

3. T. testaceipes, *Cam.*

Trybliographa testaceipes, Cam., Trans. Ent. Soc. 1883, 369.
Clyde opposite Kenmuir ; Dalry.

Genus : MICROSTILBA.

Microstilba, Foerster, Verh. z.-b. Ges. Wien, xix. 346.

1. M. heterogena, *Gir.*

Eucoila heterogena, Giraud, Verh. z.-b. Ges. Wien, ix. 137.
At Clober Dam. August.

Genus : COTHONASPIS.

Cothonaspis, Foerster, Verh. z.-b. Ges. Wien, xix. 347.

1. C. pentatoma, *Htg.*

Cothonaspis pentatoma, Htg., Germ. Zeit. ii. 201.
Claddich, Loch Awe.

Genus : KLEDITOMA.

Kleditoma, Westwood, Mag. Nat. Hist. vi.

1. K. BREVICORNIS, *Thoms.*

Kleditoma brevicornis, Thoms., Oef. 1861, 400.
Clober, Thornhill, Dumfries, New Galloway.
Bonar Bridge.

2. K. NIGRA, *Thoms.*

Cothonaspis niger, Htg., Germ. Zeit. ii. 201, 11.
Kleditoma nigra, Thomson, Oef. 1861, 339, 10.
Dalry.

3. K. TETRATOMA, *Thoms.*

Kleditoma tetratoma, Thomson, Oef. 1867, 399, 8.
Cambuslang, Bishopton, Lochlibo, near Paisley.
Carruber Glen.

4. K. PENTATOMA, *Thoms.*

Kleditoma pentatoma, Thomson, Oef. 1861, 398.
Mugdock, Cadder, Dumfries.

5. K. ALBIPENNIS, *Thoms.*

Kleditoma albipennis, Thomson, Oef. 1861, 399.
Clober, Dumfries.

6. K. STRIATA, *sp. nov.*

Black ; legs testaceous, the coxae black ; trochanters piceous ; femora (especially the posterior) blackish in the middle ; wings hyaline ; nervures piceous-black ; antennae three-fourths of the length of the body and head together ; first joint more than double the length of second ; third nearly double the length of fourth ; fourth—ninth longer than broad, transverse, not thickened towards the apex ; the club 4-jointed, not abruptly separated, its basal joint being scarcely one-half wider than the ninth, and narrower than the second, which is more ovate and shorter than the twelfth ; the thirteenth not much longer than the twelfth. Mesonotum semi-opaque ; scutellum large, its sides strongly longitudinally striated ; the cup longish ovate, the base more acutely pointed than the apex ; metapleurae pilose, opaque, aciculate ; two stout keels (diverging slightly towards the apex) run down the metanotum ; hair fringe on base of abdomen large, griseous.

Length 2 mm.

This species clearly comes very near to *K. dolichocera*, Thoms. ; but that species differs from it in having the tenth joint of the antennae

double the width of ninth, the cup of the scutellum small, the antennal flagellum fuscous, the coxae not black.

Clyde, near Newton. August.

7. K. DOLICHOCERA, *Thoms.*

Kleditoma dolichocera, Thomson, Opus. Ent. 817.

New Galloway.

8. K. PICIPES, *sp. nov.*

Black; legs, base of abdomen and of flagellum, piceous; wings hyaline; nervures piceous; antennae nearly as long as the body, becoming gradually thicker towards the apex, without any distinct club; first joint not one-half the length of second; third not one-half the length of fourth; tenth—twelfth equal in length and nearly in thickness; last longer and thicker than preceding. Thorax shining; sides of scutellum finely striated, its cup minute; metanotum opaque, finely punctured; the keels nearly parallel; wings slightly but clearly emarginate at apex; radial cellule narrow. Female.

Length 1·5 mm.

Easily known from the preceding species by the longish antennae without any abruptly separated club.

GENUS: HEXACOLA.

Hexacola, Foerster, Verh. z.-b. Ges. Wien, xix. 349.

1. H. PICICRUX, *Gir.*

Eucoila picicrux, Giraud, Verh. z.-b. Ges. Wien, ix. 325.

Clober.

Glen Tromie, Inverness-shire, Rannoch, Bonar Bridge.

GENUS: HEXAPLASTA.

Hexaplasta, Foerster, Verh. z.-b. Ges. Wien, xix. 359.

1. H. HEXATOMA, *Htg.*

Hexatoma, Htg., Germ. Zeit. iii. 357.

Clyde near Newton.

Bonar Bridge, Carruber Glen.

Tribe: ANACHARIDES.

GENUS: ANACHARIS.

Anacharis, Dal., Anal. Ent. 95.

Megapelmus, Htg., Germ. Zeit. ii. 186.

1. A. TYPICA, *Walker.*

Anacharis typica, Walker, Ent. Mag. ii. 520.
Megapelmus speciformis, Htg., Germ. Zeit. ii. 202.
Cadder, Clober.
Beauly, Kingussie.

2. A. EUCHAROIDES, *Dal.*

Cynips eucharoides, Dal., Acta Holm. 1818, 78.
Bishopton, Cadder, Strathblane, Claddich.

3. A. ENSIFER, *Walker.*

Anacharis ensifera, Walker, Ent. Mag. ii. 522.
Possil, Cadder, Bishopton, Kilsyth, Dumfries.
Glen Feshie.

4. A. IMMUNIS, *Walker.*

Anacharis immunis, Walker, Ent. Mag. ii. 521.
Cynips petiolata, Zett. Ins. Lap. 409.
Anacharis Staegeri, Dbm., Ony. och Call., pl. 2, f. 10.
Megapelmus rufiventris, Htg., *l. c.* iii. 358.
Cadder.
Glen Feshie.

GENUS : AEGILIPS.

Aegilips (Haliday), Walker, Ent. Mag. iii. 159.

1. AE. NITIDULUS, *Dalm.*

Cynips nitidula, Dalman, Anal. Ent. 95.
Bonar Bridge, near Beauly.

2. AE. RUFICORNIS, *Cam.*

Aegilips ruficornis, Cameron, Trans. Ent. Soc. 1883, 372.
Bishopton.

3. AE. DALMANNI, *Reinh.*

Aegilips Dalmanni, Reinhard, B. E. Z. ix. 220, 3.
Glen Feshie, Inverness-shire.

4. AE. SUBULIFERA, *Thoms.*

Aegilips subulifera, Thomson, Oef. viii. 412.
Cadder.
Strathglass.

5. AE. STRIOLATA, *Cam.*

Aegilips striolata, Cameron, Trans. Ent. Soc. 1883, 383.
Clober.

6. AE. SCOTICA, *Cam.*

Aegilips scotica, Cameron, Trans. Ent. Soc. 1883, 372.
Glen Morriston.

7. AE. ABIETINA, *Dbm.*

Anacharis abietina, Dbm., Onych. och Cal. Syn. tab. ii. 22.
Clober, Cadder Wilderness.

Tribe: FIGITIDES.

GENUS: FIGITES.

Figites, Latr., Hist. Ins. xiii. 210.
Psilogaster, Htg., Germ. Zeit. ii. 187.

1. F. CONSOBRINUS, *Gir.*

Figites consobrinus, Gir., Verh. z.-b. Ges. Wien., 153.
Possil, Dumfries, Dalry.

2. F. SCUTELLARIS, *Latr.*

Figites scutellaris, Latr., Hist. Ins. xiii. 220.
Ophion abbreviator, Panz., Fauna Germ. 73, 16.
Psilogaster tibialis, Htg., Germ. Zeit. ii. 203.
Cambuslang.

3. F. NITENS, *Htg.*

Psilogaster nitens, Htg., Germ. Zeit. iv. 418.
Figites coaracea, Dbm., Sk. Fauna, 228.
Do. larvarum, Dbm., *l. c.* 217.
Bishopton.

GENUS: MELANIPS.

Melanips (Haliday), Walker, Ent. Mag. iii. 161.
Scytodes, Htg., Germ. Zeit. ii. 187.
Ambylnotus, Htg., *l. c.* 419

1. M. OPACUS, *Htg.*

Scytodes opacus, Htg., Germ. Zeit. ii. 202.
Cadder, Ballantrae.

2. M. FEMORALIS, *Cam.*

Melanips femoralis, Cameron, Trans. Ent. Soc. 1883, 371.
Bonar Bridge.

GENUS: PYCNOTRICHIA.

Pycnotrichia, Foerster, Verh. z.-b. Ges. Wien, xix. 366.

1. P. URTICARUM, *Dbm.*

Figites urticarum, Dbm., Skand. Fn. 16, 3.
Do. laevigatus, Reinhard, B. E. Z. iv. 233, 4.
Cadder, Cambuslang, Bishopton.

GENUS : SAROTHRUS.

Sarothrus, Htg., Germ. Zeit. ii. 203.

1. S. CANALICULATUS, *Htg.*

Sarothrus canaliculatus, Htg., *l. c.*
Common—Kenmuir, Cadder, Mugdock, Dumfries.
Bonar Bridge.

GENUS : CHARIPS, *Haliday MS.*

1. C. MICROCERA, *Cam.*

Charips microcera, Cameron, Trans. Ent. Soc. 1879, 117.
Dalry, New Galloway, Colvend, Dumfries.

ABSTRACT.

Gall-making Species, ...					36
Inquiline „					14
Parasitic „					
Allotriina	28				
Eucoilides	24				
Anacharides	11				
Figitides	8				71
	—				—
				Total,	121

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